Foreword

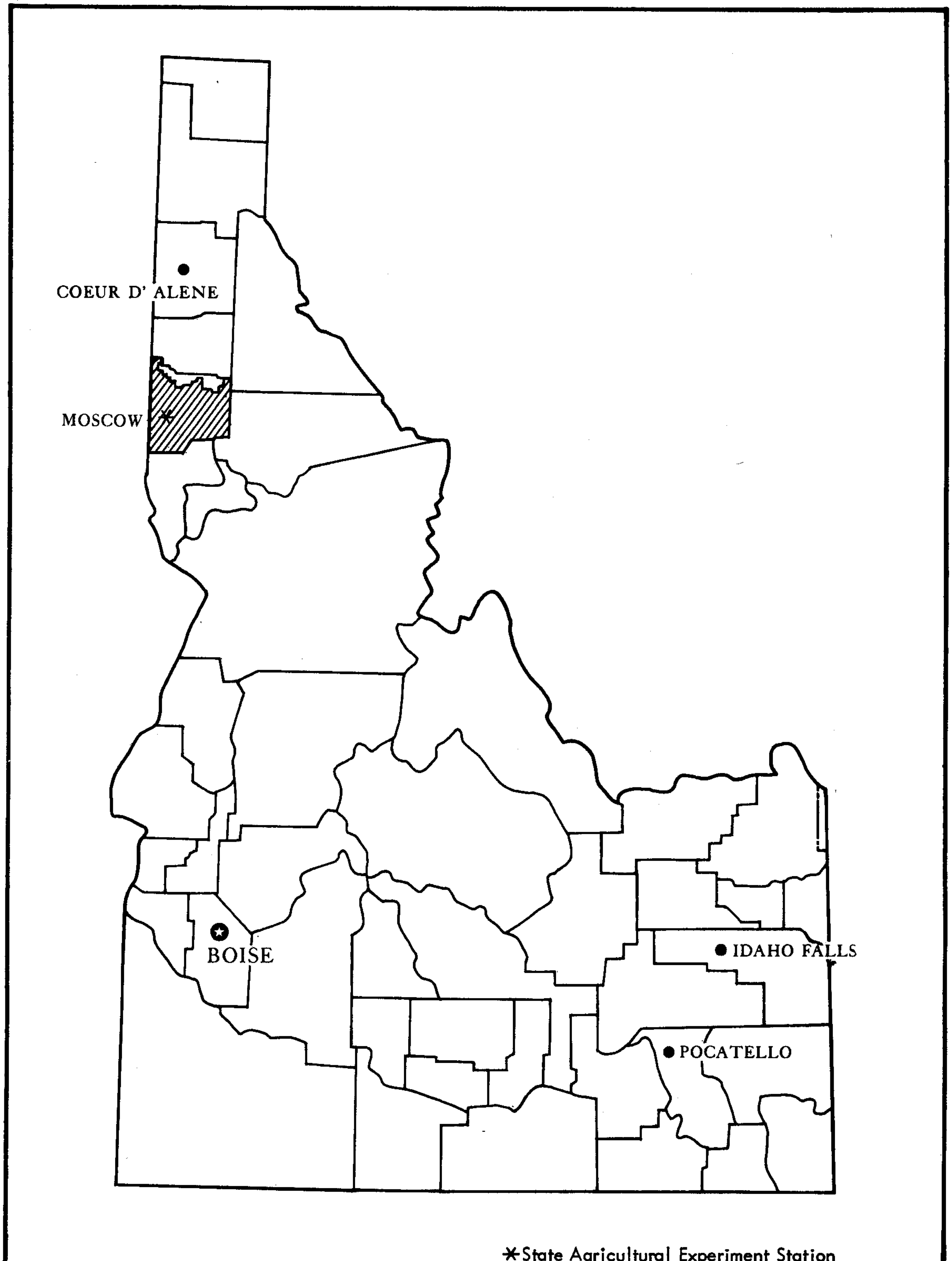
This soil survey contains information that can be used in land-planning programs in Latah County Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Amos I. Garrison, Jr.
State Conservationist
Soil Conservation Service



Location of Latah County Area in Idaho.

soil survey of
Latah County Area, Idaho

United States Department of Agriculture
Soil Conservation Service in cooperation
with

University of Idaho, College of Agriculture
Idaho Soil Conservation Commission

By Raymond J. Barker, Soil Conservation Service

Fieldwork by Raymond J. Barker, Steve R. Base
Mark E. Johnson, and Harry C. McCarver, Soil Conservation Service, and
Kenneth T. Wotring, Idaho Soil Conservation Commission

LATAH COUNTY AREA, IDAHO, is in the southwestern part of Latah County. The total area is 482,000 acres, or about 753 square miles. Moscow, the county seat and largest town, has a population of 14,146 according to the 1970 census. It is also the location of the University of Idaho. Other towns in the area are Deary, Genesee, Juliaetta, Kendrick, Potlatch, and Troy.

Most of the survey area is a broad loess-covered plain about 2,400 to 3,000 feet above sea level. The soils generally are very deep, loamy, and gently sloping to steep. A large part of this area is cultivated. The main crops are wheat, barley, and peas. Woodland is mostly in the higher rainfall zones in the northern and eastern parts of the survey area. The western part includes the dunelike topography of the Palouse hills.

Dissecting the loess-covered plain are deep canyons along the Potlatch River and its tributaries in the southern part of the survey area. The soils generally are shallow and moderately deep on south-facing slopes and very deep on north-facing slopes. The soils are steep and very steep. Rock fragments are common in the soils. Most areas of these canyons are in woodland. Rangeland is on south-facing slopes near Juliaetta and Kendrick. Elevation ranges from about 1,000 feet above sea level along the Potlatch River to about 2,800 feet.

Wooded ridges and low mountains occur above the loess-covered plain along Paradise Ridge, Tomer Butte, and the Palouse Range and in the northern part of the soil survey area. Here the soils generally are deep and very deep. Rock fragments are common in the soils. The soils are steep and very steep. Volcanic ash is common on north-facing slopes. The highest elevation in the survey area is Moscow Mountain, which is 4,983 feet above sea level.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General nature of the survey area

This section provides general information about Latah County Area, Idaho. It discusses settlement, natural resources, farming, and climate.

Settlement

Latah County, of which this soil survey area is a major part, was established in 1888 by an Act of Congress.

The first known white men to pass through the area were Captain Pierce and his men in 1861.

The first permanent settlements in the area were established near Moscow and Genesee in the early 1870's. Rapid settlement followed as settlers from many parts of the United States found the soils very productive. At first the early settlers raised a wide variety of crops, including beans, prunes, apples, cherries, and safflower. The main commercial crops, however, became wheat, barley, peas, and lentils.

Homesteaders also settled on timber lands in the forested parts of the survey area. Many sawmills were constructed to process the logs from newly cleared land. The mill at Potlatch in those early years was one of the largest in the United States.

Railroads were extended into the area in the 1890's. Young engineers who surveyed the route up the Palouse River were from the eastern United States. They named depots and trading posts along the route after eastern colleges: Harvard, Princeton, Vassar, and Yale.

The railroads greatly expanded the marketing of crops and lumber at a time when roads to market were often barely passable. This accelerated the settlement of the area.

Natural resources

Soil is the most important natural resource in the survey area. Among the marketable products derived from the soil are the crops produced on the farms; the livestock that graze the rangeland, pastures, and woodland; and the trees that are harvested.

To provide adequate water for the farms, several hundred ponds have been built to supplement the water available from streams. No extensive areas of underground water have been found in sufficient volume for irrigation.

Farming

Most of the southern and western parts of the survey area are used for cultivated crops, mainly wheat, dry peas, barley, lentils, oats, hay, and pasture. Smaller acreages are used for production of alfalfa, grass, rape, and clover seed. High yields are obtained, especially of winter wheat and peas.

Soil erosion began soon after the land was first cultivated or cleared of trees. Voluntary soil conservation associations were established in four communities in 1936 to begin a concerted effort to combat soil erosion and the resultant siltation on the flood plain. The Latah Soil Conservation District was formed in 1940 under Idaho State Law Title 22, Chapter 27, known as the Soil Conservation Districts Laws. It was the first legal soil conservation district to be formed in Idaho.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Moscow in the period 1951-73. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 32 degrees F, and the average daily minimum temperature is 25 degrees. The lowest temperature on record, which occurred at Moscow on December 30, 1968, is -42 degrees. In summer the average temperature is 63 degrees, and the average daily maximum temperature is 80 degrees. The highest recorded temperature, which occurred at Moscow on August 4, 1961, is 109 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 23.37 inches. Of this, 8 inches, or 35 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 7 inches. The heaviest 1-day rainfall during the period of record was 2.1 inches at Moscow on November 26, 1964. Thunderstorms occur on about 16 days each year, and most occur in summer.

Average seasonal snowfall is 47 inches. The greatest snow depth at any one time during the period of record was 36 inches. On an average of 20 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 65 percent.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nation-wide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure: The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The map units in this survey area are described on the following pages.

Nearly level silt loams on valley floors and flood plains

This group consists of 2 map units. It makes up about 3 percent of this survey area. The vegetation in areas not cultivated is mainly grasses, shrubs, and a few trees. Elevation is 2,500 to 2,800 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is 43 to 44 degrees F, and the average frost-free season is 100 to 110 days.

The soils in this group are very deep and are moderately well drained and somewhat poorly drained. They formed in alluvium derived from mixed sources.

This group is used mainly for hayland and pastureland. It is also used for cropland.

1. Latahco-Lovell

Very *deep, somewhat poorly drained soils that formed in alluvium*

This map unit is along Cow Creek in the southwestern part of the survey area. Slope is 0 to 3 percent. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free season is about 110 days.

This unit makes up about 1 percent of the survey area. It is about 65 percent Latahco soils and 25 percent Lovell soils. The remaining 10 percent is components of minor extent.

Latahco and Lovell soils are on valley floors and flood plains. These soils are very deep and somewhat poorly drained. They formed in alluvium derived dominantly from loess. The surface and subsurface layers are medium textured. The subsoil is moderately fine textured.

Of minor extent in this unit are Westlake soils.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

The main limitation of this unit for cropland, hayland, or pastureland is a seasonal high water table. The main limitations for recreational development are a seasonal high water table, a dusty surface layer, flooding in places, and moderately slow or slow permeability. The main limitations for homesite development are flooding, a seasonal high water table, and frost action.

Wildlife habitat is limited by clean tilled farming practices. Hungarian partridge, hawks, owls, coyote, and a few ring-necked pheasant are in this unit.

2. Hampson-Crumarine

Very deep, moderately well drained and somewhat poorly drained soils that formed in alluvium

This map unit is along the Palouse River in the northern part of the survey area. Slope is 0 to 3 percent. Elevation is about 2,500 feet. The average annual precipitation is about 27 inches, the average annual air temperature is about 43 degrees F, and the average frost-free season is about 100 days.

This unit makes up about 2 percent of the survey area. It is about 55 percent Hampson soils and 35 percent Crumarine soils. The remaining 10 percent is components of minor extent.

Hampson soils are on valley floors. These soils are very deep and moderately well drained. They formed in alluvium derived from mixed sources. The soils are medium textured throughout.

Crumarine soils are on valley floors. These soils are very deep and somewhat poorly drained. They formed in alluvium derived from mixed sources. The surface layer, subsoil, and the upper part of the substratum are medium textured. The lower part of the substratum to a depth of 60 inches is gravelly and moderately coarse textured to very gravelly and coarse textured.

Of minor extent in this unit are soils that are similar to the Hampson soils but have a moderately coarse textured subsoil and soils that have a dark gray and grayish brown surface layer 20 to 40 inches thick.

Most areas of this unit are used for hayland and pastureland. A few areas are used for cropland.

The main limitation of this unit for hayland and pastureland is a seasonal high water table. The main limitations for cropland are a seasonal high water table and a short growing season. The main limitations for recreational development are a seasonal high water table, a dusty surface layer, and flooding. The main limitations for homesite development are flooding, a seasonal high water table, and frost action.

The main wildlife species in this unit are muskrat, raccoon, white-tailed deer, coyote, hawks, owls, and ducks. The unit provides prime habitat for ring-necked pheasant.

A few rainbow trout are in the upper part of the Palouse River.

Gently sloping to moderately steep silt loams on uplands

This group consists of four map units. It makes up about 68 percent of this survey area. The vegetation in areas not cultivated is mainly grasses and coniferous trees. Elevation is 2,600 to 2,900 feet. The average annual precipitation is 21 to 33 inches, the average annual air temperature is 42 to 48 degrees F, and the average frost-free season is 90 to 140 days.

The soils in this group are very deep and are well drained and moderately well drained. They formed in loess and, in places, volcanic ash.

This group is used for cropland, hayland, pastureland, and woodland.

3. Palouse-Naff

Very deep, well drained, gently sloping to moderately steep soils that formed in loess

This map unit is along the western edge of the survey area and in the southwestern part. Slope is 2 to 40 percent. The native vegetation was grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free season is about 140 days.

This unit makes up about 20 percent of the survey area. It is about 30 percent Palouse soils and 22 percent Naff soils. The remaining 48 percent is components of minor extent.

Palouse soils are on uplands. These soils are very deep and well drained. The surface layer and the upper part of the subsoil are medium textured. The lower part of the subsoil is moderately fine textured.

Naff soils are on uplands. These soils are very deep and well drained. The surface layer is medium textured. The subsoil is moderately fine textured.

Of minor extent in this unit are Thatuna, Tilma, Garfield, and Athena soils and the somewhat poorly drained Latahco soils.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

The main limitation of this unit for cropland, hayland, and pastureland is the hazard of erosion. The main limitations for recreational development are a dusty surface layer and slope. The main limitations for homesite development are slope, moderate and moderately slow permeability, and frost action. Thatuna and Tilma soils have a perched water table early in spring. The minor Latahco soils have a seasonal high water table and are subject to flooding.

Wildlife habitat is limited by the use of clean tilled farming practices. Hungarian partridge, ring-necked pheasant, hawks, owls, coyote, and ducks are in this unit.

4. Southwick-Larkin

Very deep, moderately well drained and well drained, gently sloping to moderately steep soils that formed in loess

This map unit is in the southern and western parts of the survey area. Slope is 3 to 25 percent. The vegetation in areas not cultivated is mainly coniferous trees. Elevation is 2,600 to 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free season is about 130 days.

This unit makes up about 20 percent of the survey area. It is about 44 percent Southwick soils and 35 percent Larkin soils. The remaining 21 percent is components of minor extent.

Southwick soils are on uplands. These soils are very deep and moderately well drained. The surface layer, the subsoil, and a layer below the subsoil are medium textured. The lower part of the profile is an older, buried subsoil. The buried subsoil is moderately fine textured.

Larkin soils are on uplands. These soils are very deep and well drained. They are medium textured throughout.

Of minor extent in this unit are Driscoll soils and the somewhat poorly drained Latahco and Lovell soils.

This unit is used mainly for cropland. It is also used for hayland, pastureland, and woodland.

The main limitation of the unit for cropland, hayland, and pastureland is the hazard of erosion. The main limitations for woodland are the hazard of plant competition, wetness, and the hazard of erosion. The main limitations for recreational development are slope, a dusty surface layer, and slow and moderately slow permeability. The main limitations for homesite development are slope, a seasonal perched water table, slow and moderately slow permeability, and frost action. The minor Latahco and Lovell soils are subject to flooding.

The main wildlife species in this unit, particularly in areas adjacent to cultivated fields, are ring-necked pheasant, Hungarian partridge, valley quail, hawks, and owls. Some white-tailed deer, coyote, ducks, and black bear are also present.

5. Taney-Joel

Very deep, moderately well drained and well drained, gently sloping to moderately steep, cool soils that formed in loess

This map unit is east and west of Troy and north and south of Potlatch. Slope is 3 to 35 percent. The vegetation in areas not cultivated is mainly coniferous trees. Elevation is 2,600 to 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 45 degrees F, and the average frost-free season is about 110 days.

This unit makes up about 13 percent of the survey area. It is about 65 percent Taney soils and 12 percent Joel soils. The remaining 23 percent is components of minor extent.

Taney soils are on uplands. These soils are very deep and moderately well drained. The surface layer, the subsoil, and a layer below the subsoil are medium textured. The lower part of the profile is an older, buried subsoil. The buried subsoil is moderately fine textured.

Joel soils are on uplands. These soils are very deep and well drained. The surface layer is medium textured. The subsoil is medium textured and moderately fine textured.

Of minor extent in this unit are Klickson soils and the somewhat poorly drained Crumarine soils.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

The main limitations of this unit for cropland, hayland, and pastureland are the hazard of erosion and a seasonal perched water table. The main limitations for woodland are the hazard of erosion, wetness, and the hazard of plant competition. The main limitations for recreational development are slope, a dusty surface layer, a seasonal high water table, and slow and moderately slow permeability. The main limitations for homesite development are slope, a seasonal perched water table, slow and moderately slow permeability, and frost action. The minor Crumarine soils are subject to flooding.

The main wildlife species in this unit, particularly in areas adjacent to cultivated fields, are Hungarian partridge and valley quail. Some grouse, hawks, owls, coyote, black bear, ducks, and beaver are also present. This unit provides prime habitat for white-tailed deer.

6. Santa-Helmer

Very deep, moderately well drained, gently sloping to moderately steep soils that formed in loess and volcanic ash

This map unit is in the northeastern part of the survey area near Deary and Harvard. Slope is 2 to 35 percent. The vegetation in areas not cultivated is mainly coniferous trees. Elevation is 2,800 to 2,900 feet. The average annual precipitation is 28 to 33 inches, the average annual air temperature is 42 to 43 degrees F, and the average frost-free season is 90 to 100 days.

This unit makes up about 15 percent of the survey area. It is about 75 percent Santa soils and 15 percent Helmer soils. The remaining 10 percent is components of minor extent.

Santa soils are on uplands. These soils are very deep and moderately well drained. They formed in loess. The surface layer, the subsoil, and a layer below the subsoil are medium textured. The lower part of the profile is an older, buried subsoil. The buried subsoil is medium textured and moderately fine textured.

Helmer soils are on uplands. These soils are very deep and moderately well drained. They formed in volcanic ash overlying loess. The surface layer, the subsoil, and the layer above the buried subsoil are medium textured. The buried subsoil is medium textured and moderately fine textured.

Of minor extent in this unit are the somewhat poorly drained Crumarine soils and the poorly drained Porrett soils.

This unit is used for cropland, hayland, pastureland, and woodland.

The main limitations of this unit for cropland are the hazard of erosion, a seasonal perched water table, very slow permeability, and moderately deep rooting depth. The main limitation for hayland and pastureland is the hazard of erosion. The main limitations for woodland are the hazard of erosion, wetness, and the hazard of plant competition. The main limitations for recreational development are slope, a dusty surface layer, very slow permeability, and a seasonal perched water table. The main limitations for homesite development are slope, a seasonal perched water table, and frost action.

The main wildlife species in this unit are grouse, hawks, owls, coyote, black bear, elk, Hungarian partridge, ducks, beaver, and bobcat. This unit provides prime habitat for white-tailed deer.

Very steep loams, silt loams, and gravelly silt loams on canyons and mountains

This group consists of 3 map units. It makes up about 29 percent of this survey area. The native vegetation is mainly coniferous trees and grasses. Elevation is 1,000 to 4,983 feet. The average annual precipitation is 18 to 45 inches, the average annual air temperature is 40 to 48 degrees F, and the average frost-free season is 75 to 160 days.

The soils in this group are moderately deep to very deep and well drained. They formed in residuum and colluvium derived dominantly from basalt, granite, and metasedimentary rock as well as volcanic ash and loess.

Most areas of this group are used for woodland. A few areas are used as rangeland.

7. Klickson-Bluesprin

Very deep and moderately deep, well drained soils that formed in colluvium

This map unit is in the southeastern part of the survey area. Slope is 35 to 65 percent. Elevation is 1,000 to 2,800 feet. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 44 to 48 degrees F, and the average frost-free season is 100 to 160 days.

This unit makes up about 10 percent of the survey area. It is about 35 percent Klickson soils and 17 percent Bluesprin soils. The remaining 48 percent is components of minor extent.

Klickson soils are on canyon slopes. These soils are very deep and well drained. They formed in loess and in material derived dominantly from basalt. The surface layer is cobbly and medium textured. The subsoil is very cobbly and medium textured.

Bluesprin soils are on canyon slopes. These soils are moderately deep and well drained. They formed in loess and in material derived dominantly from basalt. The surface layer is gravelly and medium textured. The lower part of the subsoil is very gravelly and moderately fine textured. Basalt is at a depth of 24 inches.

Of minor extent in this unit are Agatha, Keuterville, and Flybow soils, Aquic Xerofluvents, and Rock outcrop.

This unit is used mainly for woodland. It is also used for rangeland.

The main limitations of this unit for woodland are the hazard of erosion, slope, and the hazard of plant competition. The main limitation for rangeland is slope. This unit is poorly suited to recreational and homesite development.

This unit has the widest variety of wildlife species in the survey area. Valley quail, grouse, hawks, owls, black bear, coyote, mule deer, and bobcat are throughout the unit. Ducks, chukars, muskrat, raccoon, and beaver are at lower elevations along the Potlatch River and its tributaries. A few rainbow trout are in the upper part of the major streams. This unit is suited to wintering habitat for white-tailed deer, elk, and a few bald eagles.

8. Vassar-Uvi

Deep and very deep, well drained soils that formed in volcanic ash, loess, and granitic residuum

This map unit is in the Moscow Mountain area and in the southeast corner of the survey area. Slope is 35 to 65 percent. Elevation is 2,800 to 4,983 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is 40 to 44 degrees F, and the average frost-free season is 75 to 110 days.

This unit makes up about 12 percent of the survey area. It is about 39 percent Vassar soils and 30 percent Uvi soils. The remaining 31 percent is components of minor extent.

Vassar soils are on mountains. These soils are deep and well drained. They formed in volcanic ash overlying residuum derived dominantly from granite. The surface layer is medium textured. Below this, to a depth of 54 inches, the soils are moderately coarse textured and coarse textured. Weathered granite is at a depth of 54 inches.

Uvi soils are on mountains. These soils are very deep and well drained. They formed in loess and residuum derived dominantly from granite. The soils are medium textured throughout.

Of minor extent in this unit are Spokane and Molly soils and Rock outcrop.

This unit is used for woodland.

The main limitations of this unit for woodland are the hazard of erosion, slope, and the hazard of plant competition. This unit is poorly suited to recreational and homesite development.

This unit provides prime habitat for white-tailed deer. Other wildlife in this unit include grouse, hawks, owls, coyote, black bear, elk, beaver, bobcat, and cougar.

9. Minaloosa-Huckleberry

Very deep and moderately deep, well drained soils that formed in loess, volcanic ash, and residuum derived from shale and quartzite

This map unit is along the northern and northeastern edge of the survey area. Slope is 35 to 65 percent. Elevation is 2,700 to 4,300 feet. The average annual precipitation is 28 to 32, inches, the average annual air temperature is 43 to 44 degrees F, and the average frost-free season is 80 to 110 days.

This unit makes up about 7 percent of the survey area. It is about 50 percent Minaloosa soils and 30 percent Huckleberry soils. The remaining 20 percent is components of minor extent.

Minaloosa soils are on mountains. These soils are very deep and well drained. They formed in loess and in residuum and colluvium derived dominantly from metasedimentary rock. The surface layer is medium textured. The upper part of the subsoil is gravelly and medium textured. The lower part is very gravelly and medium textured. The substratum to a depth of 60 inches is very gravelly and extremely gravelly and is medium textured.

Huckleberry soils are on mountains. These soils are moderately deep and well drained. They formed in volcanic ash overlying residuum and colluvium derived dominantly from metasedimentary rock. The surface layer and subsoil are medium textured. The substratum to a depth of 36 inches is very gravelly and extremely cobbly and is medium textured. Weathered quartzite is at a depth of 36 inches.

Of minor extent in this unit are Farber soils.

This unit is used for woodland.

The main limitations of this unit for woodland are the hazard of erosion, slope, and the hazard of plant competition. This unit is poorly suited to recreational and homesite development.

The main wildlife species in this unit are grouse, hawks, owls, coyote, white-tailed deer, black bear, elk, bobcat, and cougar.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a soil *series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil *phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Santa silt loam, 2 to 5 percent slopes, is one of several phases in the Santa series.

Some map units are made up of two or more major soils. These map units are called soil complexes or soil associations.

A soil complex consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bluesprin-Keuterville complex, 35 to 65 percent slopes, is an example.

A soil *association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Minaloosa-Huckleberry association, very steep, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1-Agatha gravelly silt loam, 35 to 65 percent slopes. This deep, well drained soil is on canyon slopes. It formed in loess and in material weathered from basalt. The natural vegetation is mainly coniferous trees. Elevation is 2,200 to 2,800 feet. The average annual precipitation is about 27 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is brown silt loam and gravelly silt loam about 7 inches thick. The upper 11 inches of the subsoil is light brown very gravelly silt loam. The lower 40 inches is light brown very cobbly silty clay loam. Basalt is at a depth of 58 inches.

Included in this unit are small areas of Rock outcrop and Klickson cobbly loam. Also included are small areas of moderately deep soils, soils that have less than 35 percent rock fragments in the subsoil, and soils that are similar to this Agatha soil but have more than 35 percent clay in the subsoil.

Permeability of this Agatha soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge.

The site index for grand fir is about 55. This unit is capable of producing about 8,400 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

This unit is well suited to grand fir and Douglas-fir. The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as timothy, tall fescue, orchardgrass, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,000 pounds per acre to 300 pounds per acre. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

2-Aquic Xerofluvents, nearly level. This map unit is on low terraces and flood plains along stream channels. The soils formed in stratified, unconsolidated recent alluvium derived from mixed sources. They are a mixture of sand, gravel, cobblestones, and some fine textured material. Slope generally is less than 3 percent but is as much as 15 percent in places, such as on fans at the mouth of drainageways. Flooding is common. Elevation is 1,000 to 2,600 feet.

This unit is used for wildlife habitat. In places there are small included areas of loamy soils above the flood plain that are used for hayland, pastureland, and garden plots. In most places, however, the hazard of flooding precludes all farming and recreational or homesite development.

This map unit is in capability subclass VIIw.

3-Athena silt loam, 3 to 7 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 150 days.

Typically, the surface layer is very dark grayish brown and dark grayish brown silt loam 17 inches thick. The upper 13 inches of the subsoil is brown silt loam. The next 20 inches is yellowish brown silt loam. The substratum to a depth of 60 inches or more is light yellowish brown silt loam.

Included in this unit are small areas of Palouse silt loam.

Permeability of this Athena soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by a moderate hazard of erosion. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is well suited to recreational development. It is limited mainly by the dusty surface layer.

If this unit is used for homesite development, the main limitations are frost action and moderate permeability. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Septic tank absorption fields may not function properly.

This map unit is in capability subclass IIe.

4-Athena-Palouse silt loams, 7 to 25 percent slopes. This map unit is on south-facing slopes on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

This unit is about 40 percent Athena silt loam and 30 percent Palouse silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Naff, Garfield, and Tilma silt loams. Also included are small areas of soils that are similar to the Athena soil but have a brown surface layer and soils that have calcium carbonate in the surface layer.

The Athena soil is very deep and well drained. It formed in loess. Typically, the surface layer is very dark grayish brown and dark grayish brown silt loam 17 inches thick. The upper 13 inches of the subsoil is brown silt loam. The next 20 inches is yellowish brown silt loam. The substratum to a depth of 60 inches or more is light yellowish brown silt loam.

Permeability of the Athena soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

The Palouse soil is very deep and well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 15 inches thick. The upper 10 inches of the subsoil is grayish brown silt loam. The next 8 inches is brown silt loam. The next 20 inches is light yellowish brown silt loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Palouse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by the high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, frost action, and moderate permeability. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Roads and buildings should be designed to conform to the landscape. Buildings should be designed to offset the effects of slope, and roads should be designed to offset the effects of slope and frost action. Specially designed waste disposal systems may be required.

This map unit is in capability subclass IIIe.

5-Bluesprin-Flybow complex, 35 to 65 percent slopes. This map unit is on south-facing canyon slopes. The natural vegetation is mainly grasses. Elevation is 1,000 to 2,600 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 160 days.

This unit is about 40 percent Bluesprin gravelly silt loam and 20 percent Flybow very cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Bluesprin soil but has more than 35 percent clay in the subsoil, a soil that is similar to the Flybow soil but has a dark reddish brown surface layer, Rock outcrop, basalt cliffs that are 10 to 50 feet high, talus slopes, and a soil that has slopes of less than 35 percent.

The Bluesprin soil is moderately deep and well drained. It formed in loess and in residuum derived from basalt. Typically, the surface layer is dark brown gravelly silt loam 11 inches thick. The subsoil is dark brown very gravelly silty clay loam 13 inches thick. Basalt is at a depth of 24 inches.

Permeability of the Bluesprin soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The Flybow soil is very shallow and well drained. It formed in residuum derived dominantly from basalt. Typically, the surface layer is strong brown very cobbly loam 4 inches deep over basalt.

Permeability of the Flybow soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as rangeland.

The potential natural plant community on the Bluesprin soil is mainly Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and common snowberry. If the range vegetation on the Bluesprin soil is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, and Sandberg bluegrass. The average annual production of the potential natural plant community is 2,200 pounds of air-dry vegetation per acre in favorable years and 1,300 pounds in unfavorable years.

The potential natural plant community on the Flybow soil is mainly Idaho fescue, bluebunch wheatgrass, lupine, and cutleaf balsamroot. If the range vegetation on the Flybow soil is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass. The average annual production of the potential natural plant community is 600 pounds of air-dry vegetation per acre in favorable years and 300 pounds in unfavorable years.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Use of mechanical treatment practices generally is not practical, because of the very steep slopes, cobbles on the surface, very shallow depth to bedrock, and the areas of Rock outcrop. To maintain or improve the condition of the range, management practices such as proper grazing use and a planned grazing system are needed. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to recreational development. Slope and large stones limit the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitations are slope and depth to rock.

This map unit is in capability subclass VIIe.

6-Bluesprin-Keuterville complex, 35 to 65 percent slopes. This map unit is on canyon slopes. The natural vegetation is mainly grasses on the Bluesprin soil and coniferous trees on the Keuterville soil. Elevation is 1,200 to 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 40 percent Bluesprin gravelly silt loam and 25 percent Keuterville cobbly silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Flybow very cobbly loam. Also included are small areas of a soil that is similar to the Bluesprin soil but has more than 35 percent clay in the subsoil, Rock outcrop, basalt cliffs that are 10 to 50 feet high, talus slopes, and a soil that has less than 35 percent rock fragments in the subsoil.

The Bluesprin soil is moderately deep and well drained. It formed in loess and in residuum derived from basalt. Typically, the surface layer is dark brown gravelly silt loam 11 inches thick. The subsoil is dark brown very gravelly silty clay loam 13 inches thick. Basalt is at a depth of 24 inches.

Permeability of the Bluesprin soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The Keuterville soil is very deep and well drained. It formed mainly in residuum and colluvium derived from basalt. Some loess is mixed into the upper part of the soil. Typically, the upper 3 inches of the surface layer is dark brown gravelly silt loam. The lower 10 inches is dark brown cobbly silt loam. The upper 13 inches of the subsoil is dark brown very gravelly silty clay loam. The next 18 inches is dark brown extremely cobbly clay loam. The lower part to a depth of 60 inches or more is dark brown extremely gravelly clay loam.

Permeability of the Keuterville soil is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used mainly for rangeland. It is also used for woodland.

The potential natural plant community on the Bluesprin soil is mainly Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and snowberry. If the range vegetation is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, and Sandberg bluegrass. The average annual production of the potential natural plant community is 2,200 pounds of air-dry vegetation per acre in favorable years and 1,300 pounds in unfavorable years.

The potential natural plant community on the Keuterville soil is mainly ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass. This soil is well suited to the production of ponderosa pine.

The site index for ponderosa pine is about 90. This soil is capable of producing about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are slope and the hazard of water erosion. The steepness of slope limits the kinds of equipment that can be used in forest management. Minimizing the risk of erosion is essential in harvesting timber. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned.

The Keuterville soil is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this soil are bluebunch wheatgrass, pine reedgrass, elk sedge, and Idaho fescue. Management of the vegetation on this soil should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil from erosion.

This soil can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,500 pounds per acre to 100 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

7-Crumarine silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on valley floors (fig. 1). It formed in alluvium derived from mixed sources. The natural vegetation is mainly grasses, shrubs, and a few coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 1 inch thick. The surface layer is light brownish gray silt loam 4 inches thick. The subsoil is pale brown silt loam 5 inches thick. The upper 21 inches of the substratum is very pale brown loam, the next 16 inches is very pale brown gravelly sandy loam, and the lower part to a depth of 60 inches is very pale brown very gravelly loamy sand.

Included in this unit are small areas of Porrett silt loam. Also included are small areas of a soil that is similar to this Crumarine soil but does not have a gravelly layer in the substratum.

Permeability of this Crumarine soil is moderate to a depth of 46 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 6 to 18 inches late in winter and early in spring. This soil is subject to rare periods of flooding in winter and early in spring.

Most areas of this unit are used for hayland and pastureland. A few areas are used for cropland.

This unit is well suited to hay and pasture. The main limitation is wetness, which limits the choice of plants

Figure 1.-Area of Crumarine silt loam, 0 to 3 percent slopes, in foreground; Santa silt loam, 20 to 35 percent slopes, in background; and Uvi-Vassar association, very steep, on mountainsides.

and the period of cutting or grazing and increases the risk of winterkill. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to barley and oats. It is limited mainly by a seasonal high water table and a short growing season. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is poorly suited to recreational development. It is limited mainly by a seasonal high water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding and a seasonal high water table.

This map unit is in capability subclass IIIw.

8-Driscoll-Larkin silt loams, 7 to 25 percent slopes. This map unit is on uplands. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

This unit is about 40 percent Driscoll silt loam and 30 percent Larkin silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Southwick silt loam. Also included are small areas of an eroded soil that is similar to the Driscoll and Larkin soils but has a brown silt loam surface layer.

The Driscoll soil is very deep and moderately well drained. It formed in loess. Typically, the surface is covered with a mat of organic material 2.5 inches thick. The upper 6 inches of the surface layer is grayish brown silt loam. The lower 9 inches is brown silt loam. The subsoil is pale brown silt loam 16 inches thick. Next is a layer of light gray silt loam 2 inches thick. Below this is an older, buried subsoil. The upper 12 inches of the buried subsoil is yellowish brown silty clay. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Driscoll soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The buried subsoil has high shrink-swell potential.

The Larkin soil is very deep and well drained. It formed in loess. Typically, the surface is covered with a mat of organic material 1.5 inches thick. The upper 4 inches of the surface layer is dark grayish brown silt loam. The lower 11 inches is brown silt loam. The subsoil to a depth of 60 inches or more is yellowish brown silt loam.

Permeability of the Larkin soil is moderately slow. Available water-capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland, pastureland, and woodland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by a high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth bromegrass, and alfalfa.

The potential natural plant community on the Driscoll soil is mainly ponderosa pine, common snowberry, rose, and bluebunch wheatgrass.

The site index for ponderosa pine on the Driscoll soil is about 80. This soil can produce about 4,900 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The site index for ponderosa pine on the Larkin soil is about 90. This soil can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The potential natural plant community on the Larkin soil is mainly ponderosa pine, mallow ninebark, rose, and bluebunch wheatgrass.

This unit is well suited to ponderosa pine. The main concerns in producing and harvesting timber are the hazards of plant competition and water erosion. When harvesting timber on this unit, management that minimizes the risk of erosion is essential. After timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this unit are bluebunch wheatgrass, Idaho fescue, and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 1,000 pounds per acre.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If the Driscoll soil is used for homesite development, the main limitations are slope, slow permeability, shrink-swell potential, and a seasonal perched water table. If the Larkin soil is used for homesite development, the main limitations are slope, moderately slow permeability, and frost action. Measures to control surface runoff and erosion are needed on this unit if the plant cover is disturbed or removed. The hazard of erosion is increased if the soils are left exposed during site development. Roads and buildings should be designed to conform to the landscape. Specially designed waste disposal systems are required.

Buildings and roads on the Driscoll soil should be designed to offset the effects of the shrink-swell potential and slope. Buildings and roads on the Larkin soil should be designed to offset the effects of slope. Frost action limits road construction. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

9-Farber-Minaloosa association, very steep. This map unit is on mountainsides. The natural vegetation is mainly coniferous trees. Slope is 35 to.65 percent. Elevation is 2,700 to 3,900 feet. The average annual precipitation is about 26 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 120 days.

This unit is about 55 percent Farber silt loam and 30 percent Minaloosa loam.

Included in this unit are small areas of a soil that is similar to the Farber and Minaloosa soils but has a loamy subsoil. Also included are small areas of soils that are shallow to deep.

The Farber soil is very deep and well drained. It formed in loess and in residuum and colluvium derived from metasedimentary rock. It is mostly at lower elevations or on convex positions at higher elevations. Typically, the surface is covered with a mat of organic material 0.5 inch thick. The upper 7 inches of the surface layer is dark grayish brown silt loam. The lower 4 inches is brown silt loam. The upper 5 inches of the subsoil is light yellowish brown gravelly silt loam. The next 28 inches is brown very gravelly loam. The lower part to a depth of 60 inches or more is brown extremely cobbly loam.

Permeability of the Farber soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Minaloosa soil is very deep and well drained. It formed in loess and in residuum and colluvium derived from metasedimentary rock. It is mostly on east-facing slopes at lower elevations and on smooth south-facing slopes at higher elevations. Typically, the surface is covered with a mat of organic material 0.5 inch thick. The surface layer is brown loam 6 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam. The next 10 inches is light yellowish brown gravelly loam. The lower part to a depth of 34 inches is light yellowish brown very gravelly loam. The substratum to a depth of 60 inches or more is very pale brown very gravelly and extremely gravelly loam.

Permeability of the Minaloosa soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community on the Farber soil is mainly Douglas-fir, ponderosa pine, mallow ninebark, and bluebunch wheatgrass. The Farber soil is well suited to the production of Douglas-fir and ponderosa pine.

The site index for Douglas-fir on the Farber soil is about 90. This soil can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The potential natural plant community on the Minaloosa soil is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This soil is well suited to the production of Douglas-fir and grand fir.

The site index for grand fir is about 50. This soil can produce about 7,800 cubic feet per acre of trees 0.6 inch or more in diameter or 6,500 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to species such as orchardgrass, tall fescue, timothy, and white Dutch clover.

The important native understory forage plants on the Farber soil are bluebunch wheatgrass, Columbia brome, and blue wildrye. This soil can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

The important native understory forage plants on the Minaloosa soil are elk sedge, Columbia brome, and blue wildrye. This soil can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,000 pounds per acre to less than 300 pounds per acre.

Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soils. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

10-Garfield silt loam, 3 to 30 percent slopes. This very deep, well drained soil is on long narrow ridges on uplands. It formed in loess. The natural vegetation is mainly grasses. Elevation is about 2,800 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 150 days.

Typically, the surface layer is brown silt loam 8 inches thick. The upper 14 inches of the subsoil is brown silty clay loam, The lower part to a depth of 60 inches or more is light yellowish brown silt loam.

Included in this unit are small areas of Naff silt loam. Also included are small areas of a soil that is similar to this Garfield soil but has less than 35 percent clay in the subsoil.

Permeability of the Garfield soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The subsoil has high shrink-swell potential.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is poorly suited to wheat and barley. It is limited mainly by a high hazard of erosion, poor tilth, and low fertility. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures are needed to improve fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas may need to be seeded to permanent cover.

This unit is suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth bromegrass, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, slow permeability, and shrink-swell potential. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape and to offset the effects of shrink-swell potential and slope. Specially designed waste disposal systems are required. Topsoil needs to be added to establish plantings.

This map unit is in capability subclass IVe.

11-Hampson silt loam, 0 to 3 percent slopes. This very deep, moderately well drained soil. is on valley floors (fig. 2). It formed in alluvium derived from mixed sources. The natural vegetation is mainly grasses, shrubs, and a few trees. Elevation is about 2,500 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

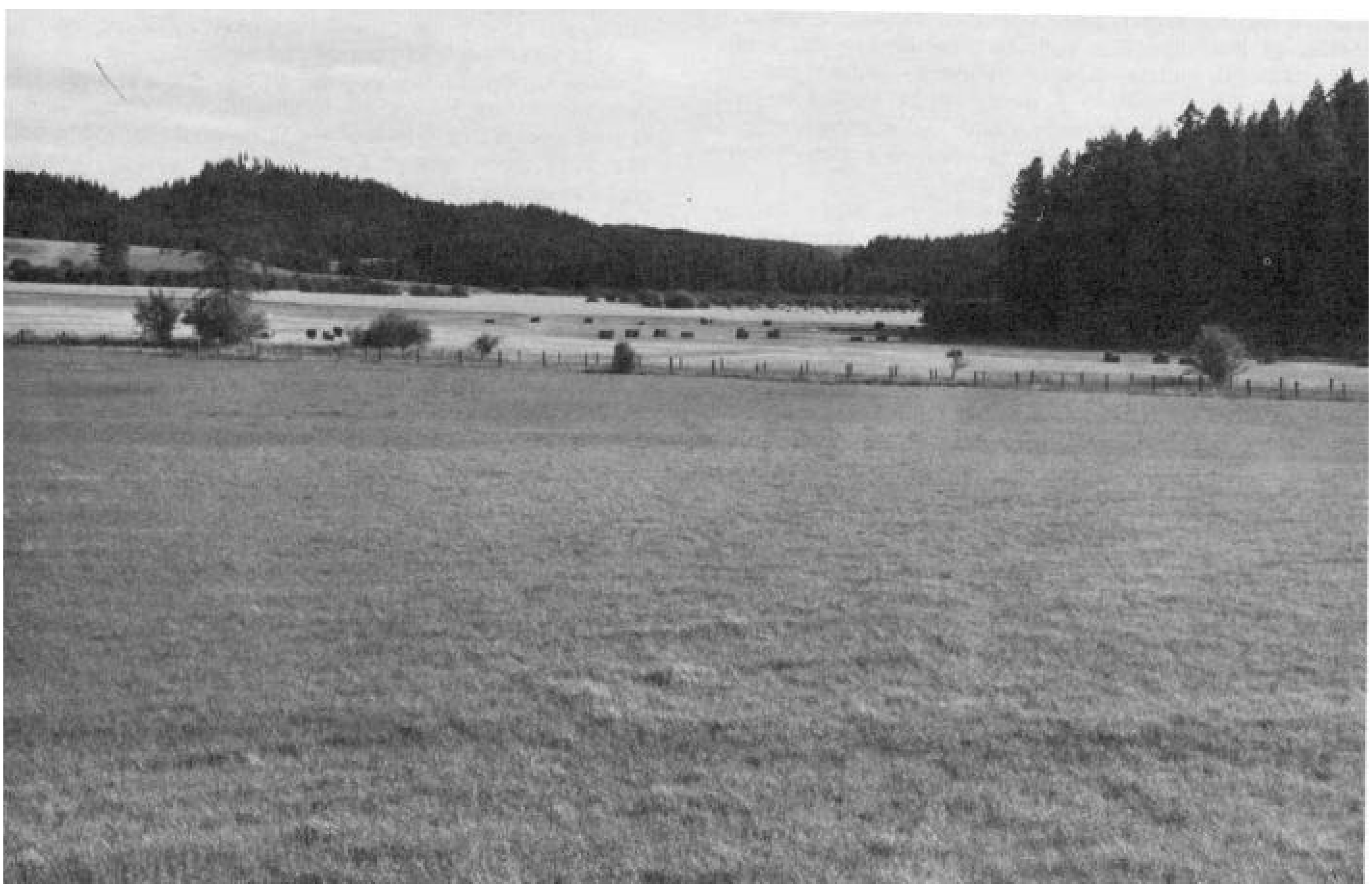


Figure 2.-Area of Hampson silt loam, 0 to 3 percent slopes. Minaloosa-Huckleberry association, very steep, in background.

Typically, the upper 11 inches of the surface layer is dark gray and gray silt loam. The lower 17 inches is grayish brown and light brownish gray silt loam. The upper 8 inches of the underlying material is light gray loam. The lower part to a depth of 60 inches or more is light brownish gray silt loam.

Included in this unit are small areas of a soil that is similar to this Hampson soil but has a fine sandy loam subsoil and a soil that has a dark gray and grayish brown surface layer 20 to 40 inches thick. Also included are small areas of a somewhat poorly drained soil that has a light brownish gray surface layer.

Permeability of this Hampson soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 36 to 60 inches late in winter and early in spring. This soil is subject to occasional, very brief periods of flooding in winter and early in spring. The potential for frost action is high.

This unit is used mainly for hayland and pastureland. It is also used for cropland. .

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is well suited to barley and oats. It is limited mainly by the seasonal high water table. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well to poorly suited to recreational development. It is limited mainly by the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, a seasonal high water table, and frost action.

This map unit is in capability subclass IIIw.

12-Helmer silt loam, 5 to 20 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in volcanic ash overlying loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,900 feet. The average annual precipitation is about 33 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 3 inches thick. The subsoil is brown silt loam 13 inches thick. Next is a layer of light yellowish brown silt loam 11 inches thick. Below this is an older, buried subsoil. The upper 10 inches of the buried subsoil is reddish yellow silt loam. The next 16 inches is light yellowish brown silty clay loam. The lower part to a depth of 60 inches or more is strong brown silt loam.

Included in this unit are small areas of Santa and Vassar silt loams. Also included are small areas of a soil that is similar to this Helmer soil but has a friable subsoil.

Permeability of the Helmer soil is very slow. Available water capacity is low. The subsoil is very compact, which greatly restricts the movement of water and the growth of roots. Effective rooting depth is 20 to 30 inches. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the subsoil early in spring. The potential frost action is high.

This unit is used mainly for woodland. It is also used for hayland, pastureland, and cropland.

The potential natural plant community is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This unit is well suited to western redcedar and western white pine.

The site index for western white pine is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,200 pounds per acre to less than 100 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, timothy, redclover, and alfalfa.

This unit is poorly suited to wheat and barley. It is limited mainly by the high hazard of erosion, the seasonal perched water table, very slow permeability, and moderately deep rooting depth. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas may need to be seeded to permanent cover.

This unit is poorly suited to recreational development. It is limited mainly by very slow permeability.

If this unit is used for homesite development, the main limitations are slope, a seasonal perched water table, very slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development.

Roads and buildings should be designed to conform to the landscape. Roads should be designed to offset the effects of slope and frost action, and buildings should be designed to offset the effects of slope and the seasonal high water table. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IVe.

13-Helmer silt loam, 20 to 35 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in volcanic ash overlying loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,900 feet. The average annual precipitation is about 33 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 3 inches thick. The subsoil is brown silt loam 13 inches thick. Next is a layer of light yellowish brown silt loam 11 inches thick. Below this is an older, buried subsoil. The upper 10 inches of the buried subsoil is reddish yellow silt loam. The next 16 inches is light yellowish brown silty clay loam. The lower part to a depth of 60 inches or more is strong brown silt loam.

Included in this unit are small areas of Santa and Vassar silt loams. Also included are small areas of a soil that is similar to this Helmer soil but has a friable subsoil.

Permeability of this Helmer soil is very slow. Available water capacity is low. The subsoil is very compact, which greatly restricts the movement of water and the growth of roots. Effective rooting depth is 20 to 30 inches. Runoff is very rapid, and the hazard of water erosion is very high. Water is perched above the subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for woodland. A few areas are used for hayland and pastureland.

The potential natural plant community is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This unit is well suited to western redcedar and western white pine.

The site index for western white pine is about 75. The unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,200 pounds per acre to less than 100 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, timothy, redclover, and alfalfa.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent cover.

This unit is poorly suited to recreational development. Slope and very slow permeability limit the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is marginally suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

14-Huckleberry silt loam, 35 to 65 percent slopes. This moderately deep, well drained soil is on mountainsides. It formed in volcanic ash overlying residuum and colluvium derived from metasedimentary rock. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 4,300 feet. The average annual precipitation is about 32 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 80 days.

Typically, the surface is covered with a mat of organic material 0.5 inch thick. The surface layer is brown silt loam 5 inches thick. The subsoil is brown silt loam 10 inches thick. The upper 8 inches of the substratum is light yellowish brown very gravelly loam. The lower part to a depth of 36 inches is light yellowish brown extremely cobbly loam. Decomposing quartzite is at a depth of 36 inches.

Included in this unit are small areas of Minaloosa loam and Helmer silt loam. Also included are small areas of a soil that is similar to this Huckleberry soil but is deep or very deep to decomposing quartzite.

Permeability of this Huckleberry soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly western redcedar, grand fir, American trailplant, and huckleberry. This unit is well suited to western redcedar and western white pine.

The site index for western white pine is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,200 pounds per acre to less than 50 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

15-Joel silt loam, 3 to 7 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The surface layer is brown silt loam 15 inches thick. The upper 11 inches of the subsoil is brown silt loam. The lower part to a depth of 60 inches or more is brown silty clay loam.

Included in this unit are small areas of Taney silt loam. Also included are small areas of a soil that is similar to this Joel soil but has a pale brown layer above the buried subsoil and a silty clay buried subsoil.

Permeability of this Joel soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by the moderate hazard of erosion. Erosion can be controlled and fertility maintained by using ,a suitable cropping system, crop residue management, minimum tillage, and proper fertilization.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, Regar bromegrass, and alfalfa.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir and ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concern in producing and harvesting timber is the hazard of plant competition. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, blue wildrye, and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is suited to recreational development. It is limited mainly by the dusty surface layer.

If this unit is used for homesite development, the main limitations are moderately slow permeability and frost action. Specially designed waste disposal systems are required. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

16-Joel silt loam, 7 to 25 percent slopes. This very deep, well drained soil is on uplands (fig. 3). It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The surface layer is brown silt loam 15 inches thick. The upper 11 inches of the subsoil is brown silt loam. The lower part to a depth of 60 inches or more is brown silty clay loam.

Included in this unit are small areas of Taney silt loam and a soil that is similar to this Joel soil but has a pale brown layer above a buried subsoil and a silty clay buried subsoil. Also included are small areas of eroded soils that have a surface layer of brown silt loam.

Permeability of this Joel soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by the high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, Regar bromegrass, and alfalfa.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir and ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of water erosion and of plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. After timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, blue wildrye, and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

Figure 3.-Area of Joel silt loam, 7 to 25 percent slopes, in foreground and on lower part of slopes. Spokane loam, 15 to 35 percent slopes, on ridges.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, moderately slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape.

Buildings should be designed to offset the effects of slope. Roads should be designed to offset the effects of slope and frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IIIe.

17-Joel silt loam, 25 to 35 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The surface layer is brown silt loam 15 inches thick. The upper 11 inches of the subsoil is brown silt loam. The lower part to a depth of 60 inches or more is brown silty clay loam.

Included in this unit are small areas of Taney silt loam. Also included are small areas of a soil that is similar to this Joel soil but has a pale brown surface layer.

Permeability of this Joel soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 ,inches or more. Runoff is very rapid, and the hazard of water erosion is very high. The potential frost action is high.

This unit is used mainly for hayland and pastureland. It is also used for woodland and cropland.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, Regar bromegrass, and alfalfa.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir and ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of water erosion and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, blue wildrye, and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent cover.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

18-Joel silt loam, 35 to 60 percent slopes. This very deep, well drained soil is on north-facing slopes of uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 3,300 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The surface layer is brown silt loam 15 inches thick. The upper 11 inches of the subsoil is brown silt loam. The lower part to a depth of 60 inches or more is brown silty clay loam.

Included in this unit are small areas of Spokane loam. Also included are small areas of a soil that is similar to this Joel soil but has a loam subsoil.

Permeability of this Joel soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. This soil has high potential frost action.

This unit is used for woodland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir and ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, blue wildrye, and pine reedgrass. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

19-Klickson silt loam, 7 to 25 percent slopes. This very deep, well drained soil is on valley sides. It formed in loess and in material derived dominantly from basalt. The natural vegetation is mainly coniferous trees. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 100 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is dark grayish brown cobbly loam 15 inches thick. The upper 11 inches of the subsoil is dark yellowish brown very cobbly loam. The lower part to a depth of 60 inches or more is yellowish brown very cobbly loam.

Included in this unit are small areas of Agatha gravelly silt loam. Also included are small areas of a soil that is similar to this Klickson soil but has less than 35 percent rock fragments in the subsoil, a soil that is not so deep to bedrock as is this Klickson soil, and Rock outcrop.

Permeability of this Klickson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for woodland. It is also used for hayland, pastureland, and cropland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and pine reedgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of water erosion and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, pine reedgrass, and Columbia brome. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, Regar bromegrass, and alfalfa.

This unit is suited to wheat and barley. It is limited mainly by a high hazard of erosion and the areas of Rock outcrop. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas or shallow and rocky areas may need to be seeded to permanent cover.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitation is slope. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape and to offset the effects of slope. Specially designed waste disposal systems are required. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IIIe.

20-Klickson silt loam, 25 to 35 percent slopes. This very deep, well drained soil is on canyon slopes. It formed in loess and in material weathered from basalt. The natural vegetation is mainly coniferous trees. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 100 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is brown cobbly loam 15 inches thick. The upper 11 inches of the subsoil is dark yellowish brown very cobbly loam. The lower part to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Included in this unit are small areas of Agatha gravelly silt loam. Also included are small areas of a soil that is similar to this Klickson soil but has less than 35 percent rock fragments in the subsoil, a soil that is not so deep to bedrock as is this Klickson soil, and Rock outcrop.

Permeability of this Klickson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Most areas of this unit are used for woodland. A few areas are used for hayland and pastureland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and pine reedgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of water erosion and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, pine reedgrass, and Columbia brome. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth bromegrass, Regar bromegrass, and alfalfa.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass Vle.

21-Klickson cobbly loam, 35 to 65 percent slopes. This very deep, well drained soil is on canyon slopes. It formed in loess and in material weathered from basalt. The natural vegetation is mainly coniferous trees. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 100 days.

Typically, the surface is covered with a mat of organic material 1 inch thick. The surface layer is brown cobbly loam 11 inches thick. The upper 8 inches of the subsoil is yellowish brown very cobbly loam. The lower part to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Included in this unit are small areas of Agatha gravelly silt loam. Also included are small areas of a soil that is similar to this Klickson soil but has less than 35 percent rock fragments in the subsoil, a soil that is not so deep to bedrock as is this Klickson soil, and Rock outcrop.

Permeability of this Klickson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, mallow ninebark, and pine reedgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. The steepness of slope limits the kinds of equipment that can be used in forest management. Minimizing the risk of erosion is essential in harvesting timber. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or, other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, pine reedgrass, and Columbia brome. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIle.

22-Klickson-Bluesprin complex, 35 to 65 percent slopes. This map unit is on canyon slopes (fig. 4). The natural vegetation is mainly coniferous trees on the Klickson soil and grasses on the Bluesprin soil. Elevation is 1,400 to 2,800 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Figure 4. -Area of Klickson-Bluesprin complex, 35 to 65 percent slopes, on left; Bluesprin-Flybow, 35 to 65 percent slopes, on right and Larkin silt loam, 3 to 12 percent slopes, on slump in foreground.

This unit is about 50 percent Klickson cobbly loam and 25 percent Bluesprin gravelly silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Agatha gravelly silt loam. Also included are small areas of a soil that is similar to this Klickson soil but has less than 35 percent rock fragments in the subsoil and small areas of Rock outcrop.

The Klickson soil is very deep and well drained. It formed in loess and in material weathered from basalt. Typically, the surface is covered with a mat of organic material 1 inch thick. The surface layer is brown cobbly loam 11 inches thick. The upper 8 inches of the subsoil is yellowish brown very cobbly loam. The lower part to a depth of 60 inches or more is light yellowish brown very cobbly loam.

Permeability of the Klickson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Bluesprin soil is moderately deep and well drained. It formed in loess and in residuum derived from basalt. Typically, the surface layer is dark brown gravelly silt loam 11 inches thick. The subsoil is dark brown very gravelly silty clay loam. Basalt is at a depth of 24 inches.

Permeability of the Bluesprin soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used mainly for woodland. It is also used for rangeland.

The potential natural plant community on the Klickson soil is mainly Douglas-fir, ponderosa pine, mallow ninebark, and pine reedgrass. This soil is well suited to the production of Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This soil can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. The steepness of slope limits the kinds of equipment that can be used in forest management. Minimizing the risk of erosion is essential in harvesting timber. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

The Klickson soil is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this soil include elk sedge, pine reedgrass, and Columbia brome. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This soil can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

The potential natural plant community on the Bluesprin soil is mainly Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and snowberry. If the range vegetation is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, and Sandberg bluegrass. The average annual production of air-dry vegetation ranges from 1,300 to 2,200 pounds.

Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. Use of mechanical treatment practices generally is not practical, because of very steep slopes and cobbles on the surface. Management practices suitable for use on this unit are proper grazing use and a planned grazing system. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

23-Larkin silt loam, 3 to 12 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation , is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The upper 4 inches of the surface layer is dark grayish brown silt loam. The lower 11 inches is brown silt loam. The subsoil to a depth of 60 inches or more is yellowish brown silt loam.

Included in this unit are small areas of Southwick and Driscoll silt loams and a soil that is similar to this Larkin soil but has a silty clay loam subsoil. Also included are small areas of eroded soils that have a surface layer of brown silt loam.

Permeability of this Larkin soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland, pastureland, and woodland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the moderate hazard of erosion. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization. In the steeper areas, cross-slope farming may be needed.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

The potential natural plant community is mainly ponderosa pine, mallow ninebark, rose, and bluebunch wheatgrass. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 90. This unit can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concern in producing and harvesting timber is the hazard of plant competition. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

The Larkin soil is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this soil are bluebunch wheatgrass and Idaho fescue. Management of the vegetation on this woodland soil should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This soil can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 900 pounds per acre.

This unit is suited to recreational development. It is limited mainly by a dusty surface layer and slope.

If this unit is used for homesite development, the main limitations are moderately slow permeability and frost action. Specially designed waste disposal systems are required. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

24-Larkin silt loam, 12 to 35 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface is covered with a mat of organic material 1.5 inches thick. The upper 4 inches of the surface layer is dark grayish brown silt loam. The lower 11 inches is brown silt loam. The subsoil to a depth of 60 inches or more is yellowish brown silt loam.

Included in this unit are small areas of Southwick and Driscoll silt loams. Also included are small areas of an eroded soil that is similar to this Larkin soil but has a brown silt loam surface layer and a soil that has a silty clay loam subsoil.

Permeability of this Larkin soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland, pastureland, and woodland.

This unit is suited to wheat, barley, and peas. It is limited mainly by a high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion.. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

The potential natural plant community is mainly ponderosa pine, mallow ninebark, rose, and bluebunch wheatgrass. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 90. This unit can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of plant competition and water erosion. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. The high-lead logging method is more efficient than most other logging methods and is less damaging to the soil surface.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance: Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this unit are bluebunch wheatgrass and Idaho fescue. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 900 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass IVe.

25-Latah silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on valley floors. It formed in alluvium derived dominantly from loess. The natural vegetation is mainly grasses and shrubs. Elevation is about 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 45 degrees F, and the average frost-free period is about 110 days.

Typically, the upper 19 inches of the surface layer is dark grayish brown silt loam. The lower 4 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is pale brown silt loam. The lower part, to a depth of 32 inches, is light gray silt loam. The upper 10 inches of the subsoil is dark gray silty clay. The lower part to a depth of 60 inches or more is light brownish gray silty clay loam.

Included in this unit are small areas of Latahco, Westlake, and Lovell silt loams. Also included are small areas of a soil that is similar to this Latah soil but has a surface layer less than 17 inches thick.

Permeability of this Latah soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the subsoil early in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The subsoil has high shrink-swell potential.

This unit is used for cropland, hayland, and pastureland.

This unit is well suited to wheat and barley. It is limited mainly by a seasonal perched water table. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is poorly suited to recreational development. It is limited mainly by a seasonal perched water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal perched water table, very slow permeability, frost action, and shrink-swell potential in the lower part of the soil.

This map unit is in capability subclass IIIw.

26-Latahco silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on valley floors. It formed in alluvium derived dominantly from loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the upper 14 inches of the surface layer is dark gray silt loam. The lower 6 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is light brownish gray silt loam. The lower part, to a depth of 28 inches, is light gray silt. The upper 18 inches of the subsoil is light brownish gray silty clay loam. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Included in this unit are small areas of Latah, Westlake, and Lovell silt loams.

Permeability of this Latahco soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the subsoil in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

Most areas of this unit are used for cropland, hayland, and pastureland.

This unit is well suited to wheat and barley. It is limited mainly by the seasonal perched water table. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is poorly suited to recreational development. It is limited mainly by a seasonal perched water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, a seasonal perched water table, moderately slow permeability, and frost action.

This map unit is in capability subclass IIIw.

27-Latahco-Lovell silt loams, 0 to 3 percent slopes. This map unit is on valley floors. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

This unit is about 55 percent Latahco silt loam and 35 percent Lovell silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Westlake silt loam.

The Latahco soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the upper 14 inches of the surface layer is dark gray silt loam. The lower 6 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is light brownish gray silt loam. The lower part, to a depth of 28 inches, is light gray silt. The upper 18 inches of the subsoil is light brownish gray silty clay loam. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Permeability of the Latahco soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the subsoil in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

The Lovell soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the surface layer is gray silt loam 5 inches thick. The subsurface layer is light gray silt loam 23 inches thick. The upper 19 inches of the subsoil is very pale brown silt loam. The lower part to a depth of 60 inches or more is very pale brown silty clay loam.

Permeability of the Lovell soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 18 to 24 inches late in winter and early in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

Most areas of this unit are used for hayland and pastureland. A few areas are used for cropland and woodland.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is well suited to wheat and barley. It is limited mainly by wetness. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

The potential natural plant community on the Latahco soil is mainly ponderosa pine, common snowberry, Douglas hawthorne, and bluebunch wheatgrass. The potential natural plant community on the Lovell soil is mainly ponderosa pine, common snowberry, Douglas hawthorne, and elk sedge. This unit is well suited to ponderosa pine.

The site index for ponderosa pine on the Latahco soil is about 125. This soil can produce about 10,800 cubic feet per acre of trees 0.6 inch or more in diameter or 49,350 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees.

The site index for ponderosa pine on the Lovell soil is about 115. This soil can produce about 9,200 cubic feet per acre of trees 0.6 inch or more in diameter or 39,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber on this unit are the hazard of flooding and wetness. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Use of equipment is limited when the soils are wet.

This unit is well suited to the production of plants suitable for grazing. The tree overstory generally is open. This allows light to reach the ground, which encourages the growth of a good understory. The potential native understory vegetation is mainly blue wildrye, pine reedgrass, Douglas hawthorne, and common snowberry. If the production of forage declines, the proportion of blue wildrye and other palatable grasses decreases and the proportion of Douglas hawthorne and common snowberry increases. Weeds and annual plants increase as the grazing condition further deteriorates.

If this unit is managed as woodland, it can produce forage for livestock and big game almost continuously. Management practices suitable for use on this unit are proper grazing use and a rotation grazing system.

This unit is poorly suited to recreational development. It is limited mainly by the seasonal high water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal high water table, and frost action.

This map unit is in capability subclass IIIw.

28-Latahco-Thatuna silt loams, 0 to 5 percent slopes. This map unit is on narrow valley floors and toe slopes. The natural vegetation is mainly grasses and coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

This unit is about 50 percent Latahco silt loam, 0 to 3 percent slopes, and 30 percent Thatuna silt loam, 2 to 5 percent slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Westlake and Latah silt loams. Also included are small areas of a soil that is similar to the Latahco soil but has a light gray surface layer.

The Latahco soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the upper 14 inches of the surface layer is dark gray silt loam. The lower 6 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is light brownish gray silt loam. The lower part, to a depth of 28 inches, is light gray silt. The upper 18 inches of the subsoil is light brownish gray silty clay loam. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Permeability of the Latahco soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is subject to occasional, brief periods of flooding in spring. Water is perched above the subsoil early in spring. The potential frost action is high.

The Thatuna soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 20 inches thick. The subsoil is brown silt loam 13 inches thick. The next 6 inches is light gray silt. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Thatuna soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat and barley. It is limited mainly by the seasonal perched water table and the moderate hazard of erosion on the Thatuna soil. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well suited to hay and pasture. If the Latahco soil is used for hay and pasture, the main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. If the Thatuna soil is used for hay and pasture, it has few limitations. Among the improved forage plants on the Latahco soil are timothy, tall fescue, meadow foxtail, red clover, and alsike clover. Among the improved forage plants on the Thatuna soil are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa. Fertilizer is needed to ensure optimum growth of grasses and legumes on these soils.

The Latahco soil is poorly suited to recreational development. It is limited mainly by a seasonal high water table and the hazard of flooding. The Thatuna soil is suited to recreational development. It is limited mainly by a dusty surface layer.

The Latahco soil is poorly suited to homesite development. The main limitations are the hazard of flooding, a seasonal perched water table, and frost action.

If the Thatuna soil is used for homesite development, the main limitations are the seasonal perched water table, slow permeability, and frost action.

Septic tank absorption fields do not function properly late in winter and in spring. Buildings should be designed to offset the effects of the seasonal high water table. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIw.

29-Lovell silt loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived dominantly from loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface layer is gray silt loam 5 inches thick. The subsurface layer is light gray silt loam 23 inches thick. The upper 19 inches of the subsoil is very pale brown silt loam. The lower part to a depth of 60 inches or more is very pale brown silty clay loam.

Included in this unit are small areas of Latahco and Westlake silt loams.

Permeability of this Lovell soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 18 to 24 inches late in winter and early in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

Most areas of this unit are used for hayland and pastureland. A few areas are used for cropland and woodland.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is well suited to wheat and barley. It is limited mainly by the seasonal high water table. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

The potential natural plant community is mainly ponderosa pine, common snowberry, Douglas hawthorne, and elk sedge. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 115. This unit can produce about 9,200 cubic feet per acre of trees 0.6 inch or more in diameter or 39,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are wetness, the hazard of plant competition, and the hazard of flooding. Use of logging equipment is restricted when the soils are wet and during periods of flooding. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is well suited to the production of forage. The tree overstory generally is open. This allows light to reach the ground, which encourages the growth of a good understory. The potential native understory vegetation is mainly blue wildrye, pine reedgrass, Douglas hawthorne, and common snowberry. If the production of forage declines, the proportion of blue wildrye and other palatable grasses decreases and the proportion of Douglas hawthorne and common snowberry increases. Weeds and annual plants increase as the grazing condition further deteriorates.

If this unit is managed as woodland, it can produce forage for livestock and big game almost continously. Management practices suitable for use on this unit are proper grazing use and a rotation grazing system.

This unit is poorly suited to recreational development. It is limited mainly by the seasonal high water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal high water table, slow permeability, and frost action. Drainage is needed if roads are constructed. Roads should be designed to offset the effects of wetness, frost action, and flooding.

This map unit is in capability subclass IIIw.

30-Minaloosa loam, 35 to 65 percent slopes. This very deep, well drained soil is on mountainsides. It formed in loess and in residuum and colluvium derived from metasedimentary rock. The natural vegetation is mainly coniferous trees. Elevation is 2,700 to 3,900 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 0.5 inch thick. The surface layer is brown loam 6 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam. The next 10 inches is light yellowish brown gravelly loam. The lower part, to a depth of 34 inches, is light yellowish brown very gravelly loam. The substratum to a depth of 60 inches or more is very pale brown very gravelly and extremely gravelly loam.

Included in this unit are small areas of Farber and Huckleberry silt loams. Also included are small areas of a soil that is similar to this Minaloosa soil but has a loamy subsoil and soils that are shallow to deep.

Permeability of this Minaloosa soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This unit is well suited to Douglas-fir and grand fir.

The site index for grand fir is about 50. This unit can produce about 7,800 cubic feet per acre of trees 0.6 inch or more in diameter or 6,500 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as timothy, tall fescue, orchardgrass, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, and blue wildrye. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

31-Minaloosa-Huckleberry association, very steep. This map unit is on mountainsides. The natural vegetation is mainly coniferous trees. Slope is 35 to 65 percent. Elevation is 2,800 to 4,300 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 95 days.

This unit is 50 percent Minaloosa loam and 30 percent Huckleberry silt loam. The Minaloosa soil is mostly on south-facing slopes, and the Huckleberry soil is mostly on north-facing slopes.

Included in this unit are small areas of a soil that is similar to the Minaloosa soil but has a loamy subsoil, and a soil that is similar to the Huckleberry soil but has less than 14 inches of volcanic ash on the surface.

The Minaloosa soil is very deep and well drained. It formed in loess and in residuum and colluvium derived from metasedimentary rock. Typically, the surface is covered with a mat of organic material 0.5 inch thick. The surface layer is brown loam 6 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam. The next 10 inches is light yellowish brown gravelly loam. The lower part, to a depth of 34 inches, is light yellowish brown very gravelly loam. The substratum to a depth of 60 inches or more is very pale brown very gravelly and extremely gravelly loam.

Permeability of the Minaloosa soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Huckleberry soil is moderately deep and well drained. It formed in volcanic ash overlying residuum and colluvium derived from metasedimentary rock. Typically, the surface is covered with a mat of organic material 0.5 inch thick. The surface layer is brown silt loam 5 inches thick. The subsoil is brown silt loam 10 inches thick. The upper 8 inches of the substratum is light yellowish brown very gravelly loam. The lower part, to a depth of 36 inches, is light yellowish brown extremely cobbly loam. Decomposing quartzite is at a depth of 36 inches.

Permeability of the Huckleberry soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community on the Minaloosa soil is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This soil is well suited to the production of Douglas-fir and grand fir.

The site index for grand fir on the Minaloosa soil is about 50. This soil can produce about 7,800 cubic feet per acre of trees 0.6 inch or more in diameter or 6,500 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The potential natural plant community on the Huckleberry soil is mainly western redcedar, grand fir, American trailplant, and huckleberry. This soil is well suited to the production of western redcedar and western white pine.

The site index for western white pine on the Huckleberry soil is about 75. This soil can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,500 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber on this unit are the hazard of water erosion, slope, and the hazard of plant competition. The steepness of slope limits the kinds of equipment that can be used in forest management. Minimizing the risk of erosion is essential in harvesting timber. Because the volcanic ash in the surface layer of the Huckleberry soil is highly erodible, especially careful management is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to species such as orchardgrass, tall fescue, timothy, and white Dutch clover.

The important native understory forage plants on the Minaloosa soil are elk sedge, Columbia brome, and blue wildrye. This soil can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to 400 pounds per acre.

The important native understory forage plants on the Huckleberry soil are pinegrass and thimbleberry. This soil can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,400 pounds per acre to less than 50 pounds per acre.

Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit, the movement of livestock and the accessibility of forage.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

32-Molly silt loam, 35 to 65 percent slopes. This deep, well drained soil is on mountainsides. It formed in volcanic ash over residuum derived from schist. The natural vegetation is mainly coniferous trees. Elevation is 3,200 to 4,200 feet. The average annual precipitation is about 32 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

Typically, the surface layer is covered with a mat of organic material 0.5 inch thick. The surface layer is brown silt loam 12 inches thick. The upper 16 inches of the underlying material is brown loam. The lower part, to a depth of 59 inches, is light brown and light yellowish brown loam. Decomposing schist is at a depth of 59 inches.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to this Molly soil but is very deep and moderately deep.

Permeability of this Molly soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly western redcedar, grand fir, pachystima, and mountain blueberry. This unit is well suited to grand fir and western redcedar.

The site index for grand fir is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion and slope. The steepness of slope limits the kinds of equipment that can be used in forest management. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site. index. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,200 pounds per acre to less than 100 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

33-Naff-Palouse silt loams, 7 to 25 percent slopes. This map unit is on south-facing slopes on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 45 percent Naff silt loam and 30 percent Palace silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Wilma, Garfield, and Thatuna silt loams. Also included are small areas of an eroded soil that is similar to the Naff soil but has a brown surface layer.

The Naff soil is very deep and well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 7 inches thick. The upper 40 inches of the subsoil is brown silty clay loam. The lower part to a depth of 60 inches or more is yellowish brown silty clay loam.

Permeability of the Naff soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

The Palouse soil is very deep and well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 15 inches thick. The upper 10 inches of the subsoil is grayish brown silt loam. The next 8 inches is brown silt loam. The next 20 inches is light yellowish brown silt loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Palouse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, moderately slow and moderate permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape. Buildings should be designed to offset the effects of slope, and roads should be designed to offset the effects of slope and frost action. Specially designed waste disposal systems are required. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

34-Naff-Thatuna silt loams, 7 to 25 percent slopes. This map unit is on north-facing slopes on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 40 percent Naff silt loam and 30 percent Thatuna silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tilma, Garfield, and Palouse silt loams. Also included are small areas of an eroded soil that is similar to the Naff and Thatuna soils but has a brown surface soil.

The Naff soil is very deep and well drained. It formed in loess. Typically, the surface layer is very dark grayish brown silt loam 7 inches thick. The upper 40 inches of the subsoil is brown silty clay loam. The lower part to a depth of 60 inches or more is yellowish brown silty clay loam.

Permeability of the Naff soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

The Thatuna soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 20 inches thick. The subsoil is brown silt loam 13 inches thick. The next layer is light gray silt 6 inches thick. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Thatuna soil is slow. Available water capacity is .high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the high hazard of erosion and the seasonal perched water table of the Thatuna soil. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If the Naff soil is used for homesite development, the main limitations are slope, moderately slow permeability, and frost action. If the Thatuna soil is used for homesite development, the main limitations are slope, the seasonal perched water table, slow permeability, and frost action.

Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed from these soils. The hazard of erosion is increased if the soils are left exposed during site development.

Roads and buildings should be designed to conform to the landscape. Roads should be designed to offset the effects of slope and frost action. Buildings on the Naff soil should be designed to offset the effects of slope, and those on the Thatuna soil should be designed to offset the effects of slope and the seasonal high water table. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IIIe.

35-Palouse silt loam, 3 to 7 percent slopes. This very deep, well drained soil is on uplands. It formed in loess. ,The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typically, the surface layer is dark grayish brown silt loam 15 inches thick. The upper 10 inches of the subsoil is grayish brown silt loam. The next 8 inches is brown silt loam. The next 20 inches is light yellowish brown silt loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Athena silt loam.

Permeability of this Palouse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the moderate hazard of erosion. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is suited to recreational development. It is limited mainly by a dusty surface layer.

If this unit is used for homesite development, the main limitations are frost action and moderate permeability. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Septic tank absorption fields may not function properly on this unit.

This map unit is in capability subclass IIe.

36-Palouse silt loam, 7 to 25 percent slopes. This very deep, well drained soil is on south-facing slopes on uplands. It formed in loess. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typically, the surface layer is dark grayish brown silt loam 15 inches thick. The upper 10 inches of the subsoil is grayish brown silt loam. The next 8 inches is brown silt loam. The next 20 inches is light yellowish brown silt loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Naff silt loam.

Permeability of this Palouse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, moderate permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development.

Roads and buildings should be designed to conform to the landscape. Buildings should be designed to offset the effects of slope. Roads should be designed to offset the effects of slope and frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IIIe.

37-Palouse-Latahco silt loams, 0 to 3 percent slopes. This map unit is on low terraces. The natural vegetation is mainly grasses and coniferous trees. Elevation is about 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

This unit is about 50 percent Palouse silt loam, 2 to 3 percent slopes, and 35 percent Latahco silt loam, 0 to 3 percent slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Thatuna silt loam. Also included are small areas of Palouse and Thatuna soils that have steeper slopes.

The Palouse soil is very deep and well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 15 inches thick. The upper 10 inches of the subsoil is grayish brown silt loam. The next 8 inches is brown silt loam. The next 20 inches is light yellowish brown silt loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Palouse soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The potential frost action is high.

The Latahco soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the upper 14 inches of the surface layer is dark gray silt loam. The lower 6 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is light brownish gray silt loam. The lower part, to a depth of 28 inches, is light gray silt. The upper 18 inches of the subsoil is light brownish gray silty clay loam. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Permeability of the Latahco soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the subsoil early in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

This unit is used mainly for cropland. It is also used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the seasonal perched water table of the Latahco soil. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well suited to hay and pasture.

If the Palouse soil is used for hay and pasture, it has few limitations. Among the improved forage plants suitable for use on this soil are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

If the Latahco soil is used for hay and pasture, the main limitations are wetness and the hazard of flooding. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Among the improved forage plants suitable for use on this soil are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

Fertilizer is needed to ensure optimum growth of grasses and legumes on this unit. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

The Palouse soil is suited to recreational development. It is limited mainly by a dusty surface layer. The Latahco soil is poorly suited to recreational development. It is limited mainly by the seasonal high water table and the hazard of flooding.

If the Palouse soil is used for homesite development, the main limitations are frost action and moderate permeability. Roads should be designed to offset the effects of frost action. Septic tank absorption fields may not function properly.

The Latahco soil is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal perched water table, moderately slow permeability, and frost action. Roads should be designed to offset the effects of wetness, frost action, and flooding.

This map unit is in capability subclass IIe.

38-Porrett silt loam, 0 to 3 percent slopes. This very deep, poorly drained soil is on valley floors. It formed in alluvium derived dominantly from loess and volcanic ash. The natural vegetation is mainly coniferous trees. Elevation is about 2,700 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 80 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is light brownish gray silt loam 5 inches thick. The subsurface layer is light gray silt loam 19 inches thick. The upper 8 inches of the subsoil is pale brown silty clay loam. The lower part to a depth of 60 inches or more is light gray and light brownish gray silt loam.

Included in this unit are small areas of Lovell and Crumarine silt loams. Also included are small areas of a soil that is similar to this Porrett soil but has a dark grayish brown surface layer and soils that have a fine textured subsoil.

Permeability of this Porrett soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of less than 12 inches in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

This unit is used for hayland, pastureland, and rangeland.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

The potential natural plant community on the Porrett soil is mainly tufted hairgrass, sedges, and Douglas hawthorn. The average annual production of air-dry vegetation ranges from 1,500 to 3,000 pounds. The use of the forage by livestock is limited by wetness and the hazard of flooding. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Management practices suitable for use on this soil are fertilization, seeding when needed, rotation grazing, and proper grazing use.

This unit is poorly suited to recreational development. It is limited by a seasonal high water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal high water table, frost action, and moderately slow permeability. Roads should be designed to offset the effects of wetness, frost action, and the hazard of flooding.

This map unit is in capability subclass IVw.

39-Santa silt loam, 2 to 5 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 100 days.

Typically, the surface layer is light yellowish brown silt loam 8 inches thick. The subsoil is light yellowish brown silt loam 15 inches thick. Below this is a layer of very pale brown silt loam 3 inches thick. The upper 4 inches of the buried subsoil is light yellowish brown silt loam.

The next 7 inches is strong brown silty clay loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam and silt loam.

Included in this unit are small areas of a soil that is similar to this Santa soil but does not have a very compact buried subsoil.

Permeability of this Santa soil is very slow. Available water capacity is moderate. The buried subsoil is very compact, which greatly restricts the movement of water and the growth of roots. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the buried subsoil early in spring. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is suited to wheat and barley. It is limited mainly by the moderate hazard of erosion, the seasonal perched water table, very slow permeability, and moderately deep rooting depth. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, and red clover.

The potential natural plant community is mainly grand fir, Douglas-fir, elk sedge, and pachystima. This unit is well suited to grand fir and Douglas-fir.

The site index for grand fir is about 60. This unit can produce about 9,000 cubic feet per acre of trees 0.6 inch or more in diameter or 17,900 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are wetness and the hazard of plant competition. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, bluegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to less than 200 pounds per acre,

This unit is poorly suited to recreational development. It is limited mainly by very slow permeability.

If this unit is used for homesite development, the main limitations are very slow permeability, the seasonal perched water table, and frost action. Specially designed waste disposal systems are required. Buildings should be designed to offset the effects of wetness. Roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IVe.

40-Santa silt loam, 5 to 20 percent slopes. This very deep, moderately well drained soil is on uplands (fig. 5). It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 100 days.

Typically, the surface layer is light yellowish brown silt loam 8 inches thick. The subsoil is light yellowish brown silt loam 15 inches thick. Next is a layer of very pale brown silt loam 3 inches thick. Below this is an older, buried subsoil. The upper 4 inches of the buried subsoil is light yellowish brown silt loam. The next 7 inches is strong brown silty clay loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam and silt loam.

Included in this unit are small areas of a soil that is similar to this Santa soil but does not have a very compact buried subsoil.

Permeability of this Santa soil is very slow. Available water capacity is moderate. The buried subsoil is very compact, which greatly restricts the movement of water and the growth of roots. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is poorly suited to wheat and barley. It is limited mainly by the high hazard of erosion, the seasonal perched water table, very slow permeability, and limited rooting depth. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas may need to be seeded to permanent cover. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good

Figure 5.-Area of Santa silt loam, 5 to 20 percent slopes. Coniferous trees have been cleared for cultivation.

condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

The potential natural plant community is mainly grand fir, Douglas-fir, elk sedge, and pachystima. This unit is well suited to grand fir and Douglas-fir.

The site index for grand fir is about 60. This unit can produce about 9,000 cubic feet per acre of trees 0.6 inch or more in diameter or 17,900 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Use of equipment is limited when the soil is wet. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, bluegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to less than 200 pounds per acre.

This unit is poorly suited to recreational development. It is limited mainly by very slow permeability.

If this unit is used for homesite development, the main limitations are slope, the seasonal perched water table, very slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development.

Roads and buildings should be designed to conform to the landscape. Roads should be designed to offset the effects of slope and frost action, and buildings should be designed to offset the effects of slope and the seasonal high water table. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IVe.

41-Santa silt loam, 20 to 35 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 100 days.

Typically, the surface layer is light yellowish brown silt loam 8 inches thick. The subsoil is light yellowish brown silt loam 15 inches thick. Next is a layer of very pale brown silt loam 3 inches thick. Below this is an older, buried subsoil. The upper 4 inches of the buried subsoil is light yellowish brown silt loam. The next 7 inches is strong brown silty clay loam. The lower part to a depth of 60 inches or more is light yellowish brown silty clay loam and silt loam.

Included in this unit are small areas of a soil that is similar to this Santa soil but does not have a very compact buried subsoil.

Permeability of this Santa soil is very slow. Available water capacity is moderate. The buried subsoil is very compact, which greatly restricts the movement of water and the growth of roots. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for woodland. A few areas are used for cropland, hayland, and pastureland.

The potential natural plant community is mainly grand fir, Douglas-fir, elk sedge, and pachystima. This unit is well suited to grand fir and Douglas-fir.

The site index for grand fir is about 60. This unit can produce about 9,000 cubic feet per acre of trees 0.6 inch or more in diameter or 17,900 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, bluegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to less than 200 pounds per acre.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent cover.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

This unit is poorly suited to recreational development. Slope and very slow permeability limit the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

42-Schumacher silt loam, 10 to 35 percent slopes. This deep, well drained soil is on uplands. It formed in loess and in residuum derived dominantly from metasedimentary or granitic rock. The natural vegetation is mainly grasses, shrubs, and a few coniferous trees. Elevation is 2,700 to 3,800 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 130 days.

Typically, the surface layer is dark grayish brown silt loam 19 inches thick. The upper 14 inches of the subsoil is brown silt loam. The next 12 inches is yellowish brown silt loam. The lower part, to a depth of 56 inches, is brown gravelly loam. Partially consolidated metasedimentary rock is at a depth of 56 inches.

Included in this unit are small areas of Schumacher Variant and Spokane loams. Also included are small areas of a soil that is similar to this Schumacher soil but has a clayey subsoil.

Permeability of this Schumacher soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for rangeland. It is also used for cropland, hayland, and pastureland.

The potential natural plant community on this unit is mainly Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and snowberry. If the range vegetation is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, prairie junegrass, and Sandberg bluegrass. The average annual production of air-dry vegetation ranges from 800 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. To maintain or improve the condition of the range, management practices such as proper grazing use and a planned grazing system are needed. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This unit is suited to wheat, barley, and peas. It is limited mainly by the high hazard of erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas or shallow and rocky areas may need to be seeded to permanent cover.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites:

This map unit is in capability subclass IIIe.

43-Schumacher Variant loam, 15 to 55 percent slopes. This shallow, well drained soil is on uplands. It formed in loess and in residuum derived dominantly from metasedimentary or granitic rock. The natural vegetation is mainly grasses. Elevation is 2,800 to 3,800 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 150 days.

Typically, the surface layer is brown loam 10 inches thick. The upper 5 inches of the subsoil is yellowish brown very gravelly loam. The lower 4 inches is brown extremely gravelly loam. Highly fractured, weathered quartzite is at a depth of 19 inches.

Included in this unit are small areas of Schumacher silt loam. Also included are small areas of Rock outcrop and a soil that is similar to the Schumacher soil but has a clayey subsoil.

Permeability of this Schumacher Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Some roots extend deeper into fractures in the quartzite. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for rangeland.

The potential natural plant community is mainly Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, and arrowleaf balsamroot. If the range vegetation on this unit is in good or excellent condition, the native grasses are mainly Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass. The average annual production of air-dry vegetation ranges from 500 to 1,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. To maintain or improve the condition of the range, management practices such as proper grazing use and a planned grazing system are needed. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This unit is poorly suited to recreational development. Slope and depth to rock limit the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIe.

44-Southwick silt loam, 3 to 12 percent slopes. This very deep, moderately well drained soil is on uplands (fig. 6). It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface layer is grayish brown silt loam 11 inches thick. The upper 7 inches of the subsoil is grayish brown silt loam. The lower 10 inches is brown silt loam. The upper 6 inches of the next layer is light brownish gray silt loam. The lower part, to a depth of 38 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is pale brown silty clay loam.

Included in this unit are small areas of Larkin and Driscoll silt loams. Also included are small areas of a soil that is similar to this Southwick soil but has a surface layer more than 20 inches thick.

Permeability of this Southwick soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland, pastureland, and woodland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the moderate hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization. In the steeper areas, cross-slope farming may be needed. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

The potential natural plant community is mainly ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of plant competition and wetness. After

Figure 6.-Area of Southwick silt loam, 3 to 12 percent slopes.

the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Use of equipment is limited when the soil is wet.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this unit are bluebunch wheatgrass, Idaho fescue, arrowleaf balsam root, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 500 pounds per acre.

This unit is suited to recreational development. It is limited mainly by a dusty surface layer and slope.

If this unit is used for homesite development, the main limitations are the seasonal perched water table, slow permeability, and frost action. Specially designed waste disposal systems are required. Buildings should be designed to offset the effects of the perched water table, and roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

45-Southwick silt loam, 12 to 25 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface layer is grayish brown silt loam 11 inches thick. The upper 7 inches of the subsoil is grayish brown silt loam. The lower 10 inches is brown silt loam. The upper 6 inches of the next layer is light brownish gray silt loam. The lower part, to a depth of 38 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is pale brown silty clay loam.

Included in this unit are small areas of Larkin and Driscoll silt loams and a soil that is similar to this Southwick soil but has a surface layer more than 20 inches thick. Also included are small areas of eroded soils that have a surface layer of brown silt loam.

Permeability of this Southwick soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland, pastureland, and woodland.

This unit is suited to wheat, barley, and peas. It is limited mainly by the high hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

The potential natural plant community is mainly ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of plant competition, wetness, and the hazard of water erosion. When harvesting timber, management that minimizes the risk of erosion is essential. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Use of equipment is limited when the soil is wet.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other' disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this unit are bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This soil can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 500 pounds per acre.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, the seasonal perched water table, and slow permeability. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape. Buildings should be designed to offset the effects of slope and the seasonal perched water table. Topsoil should be stockpiled and used to reclaim areas disturbed during construction. Specially designed waste disposal systems are required.

This map unit is in capability subclass IVe.

46-Southwick silt loam, 25 to 35 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface layer is grayish brown silt loam 11 inches thick. The upper 7 inches of the subsoil is grayish brown silt loam. The lower 10 inches is brown silt loam. The upper 6 inches of the next layer is light brownish gray silt loam. The lower part, to a depth of 38 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is pale brown silty clay loam.

Included in this unit are small areas of Larkin and Driscoll silt loams and eroded soils that have a surface layer of brown silt loam.

Permeability of this Southwick soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland, hayland, and pastureland. A few areas are used for woodland.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent plant cover.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

The potential natural plant community is mainly ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass. This unit is well suited to ponderosa pine.

The site index for ponderosa pine is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of plant competition, wetness, and the hazard of water erosion. When harvesting timber on this unit, management that minimizes the risk of erosion is essential. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Use of equipment is limited when the soil is wet.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. The important native understory forage plants on this unit are bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for more than 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 500 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass Vle.

47-Southwick silt loam, 7 to 35 percent slopes, eroded. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil is brown silt loam 4 inches thick. The upper 6 inches of the next layer is light brownish gray silt loam. The lower part, to a depth of 23 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is pale brown silty clay loam.

Included in this unit are small areas of Larkin and Driscoll soils. Also included are small areas of Southwick soils that have a grayish brown surface layer.

Permeability of this Southwick soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

This unit is used for cropland, hayland, and pastureland.

This unit is suited to wheat and barley. It is limited mainly by the high hazard of erosion, the seasonal perched water table, and poor tilth. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures are needed to improve fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas may need to be seeded to permanent cover. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass IVe.

48-Spokane loam, 15 to 35 percent slopes. This moderately deep, well drained soil is on mountainsides. It formed in loess and in residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is 2,800. to 3,800 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 120 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is brown loam 10 inches thick. The subsoil is light yellowish brown gravelly loam 5 inches thick. The substratum is light yellowish brown and pale brown gravelly coarse sandy loam 23 inches thick. Decomposing granite is at a depth of 38 inches.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to this Spokane soil but is very deep and a soil that has a yellowish brown surface layer.

Permeability of this Spokane soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. .

Most areas of this unit are used for woodland. A few areas are used for hayland, pastureland, and cropland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, common snowberry, and pine reedgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for ponderosa pine is about 90. This unit can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of water erosion and plant competition. Minimizing the risk of erosion is essential in harvesting timber. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, Idaho fescue, pinegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 20 to 25 years after the tree canopy is opened. During this period, total annual forage production will vary from 1,700 pounds of air-dry forage per acre to 400 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to use as cropland because of the high hazard of erosion and low available water capacity. It should be maintained in permanent cover.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

49-Spokane-Rock outcrop complex, 35 to 65 percent slopes. This map unit is on mountainsides. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 3,800 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 120 days.

This unit is about 60 percent Spokane loam and 25 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to the Spokane soil but is very deep and a soil that has a yellowish brown surface layer.

The Spokane soil is moderately deep and well drained. It formed in loess and in residuum derived dominantly from granite. Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is brown loam 10 inches thick. The subsoil is light yellowish brown gravelly loam 5 inches thick. The substratum is light yellowish brown and pale brown gravelly coarse sandy loam 23 inches thick. Decomposing granite is at a depth of 38 inches.

Permeability of the Spokane soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists mainly of large boulders of granite.

This unit is used for woodland.

The potential natural plant community on the Spokane soil is mainly Douglas-fir, ponderosa pine, common snowberry, and pine reedgrass. This soil is well suited to Douglas-fir and ponderosa pine.

The site index for ponderosa pine is about 90. This soil can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, the areas of Rock outcrop, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. The steepness of slope and the areas of Rock outcrop limit the kinds of equipment that can be used in forest management.

The Spokane soil is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this soil include bluebunch wheatgrass, Idaho fescue, pinegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This soil can produce forage for livestock and big game animals for 20 to 25 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,700 pounds per acre to 400 pounds per acre.

This unit is poorly suited to homesite development. The main limitations are slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe.

50-Taney silt loam, 3 to 7 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface layer is brown silt loam 10 inches thick. The subsoil is pale brown silt loam 6 inches thick. The upper 6 inches of the next layer is very pale brown silt loam. The lower part, to a depth of 27 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Joel silt loam. Also included are small areas of a soil that is similar to this Taney soil but has a clayey buried subsoil.

Permeability of this Taney soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the buried subsoil early in spring. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is well suited to wheat, barley, and peas. It is limited mainly by the moderate hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, Regar bromegrass, and alfalfa.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, common snowberry, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are wetness and the hazard of plant competition. Use of equipment is limited when the soil is wet. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, elk sedge, bluegrass, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 400 pounds per acre.

This unit is suited to recreational development. It is limited mainly by the seasonal perched water table., a dusty surface layer, and the moderate hazard of erosion.

If this unit is used for homesite development, the main limitations are the seasonal perched water table, slow permeability, and frost action. Septic tank absorption fields do not function properly late in winter and in spring. Buildings should be designed to offset the effects of the seasonal perched water table, and roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIle.

51-Taney silt loam, 7 to 25 percent slopes. This very deep, moderately well drained soil is on uplands (fig. 7). It formed in loess. The natural vegetation is

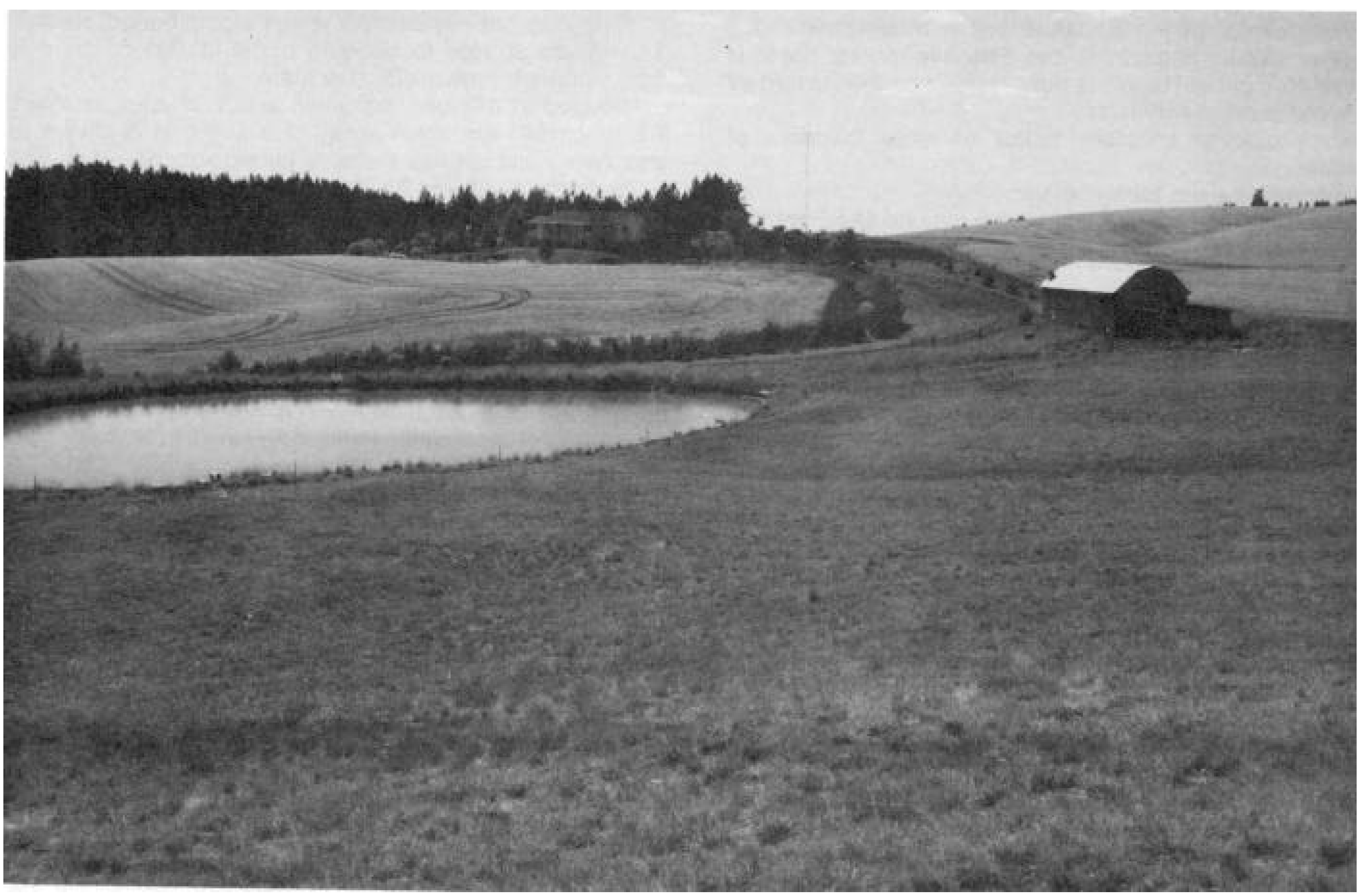


Figure 7.-Area of Taney silt loam, 7 to 25 percent slopes.

mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface layer is brown silt loam 10 inches thick. The subsoil is pale brown silt loam 6 inches thick. The upper 6 inches of the next layer is very pale brown silt loam. The lower part, to a depth of 27 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Joel silt loam. Also included are small areas of a soil that is similar to this Taney soil but has a clayey buried subsoil and eroded soils that have a surface layer of brown silt loam.

Permeability of this Taney soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

This unit is used mainly for cropland, hayland, and pastureland. It is also used for woodland.

This unit is suited to wheat, barley, and peas. It is limited mainly by the high hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, Regar bromegrass, and alfalfa.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, common snowberry, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 1.1.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, elk sedge, bluegrass, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 400 pounds per acre.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitations are slope, the seasonal perched water table, slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Specially designed waste disposal systems are required.

Roads and buildings should be designed to conform to the landscape. Buildings should be designed to offset the effects of slope and the seasonal perched water table, and roads should be designed to offset the effects of slope and frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IVe.

52-Taney silt loam, 25 to 35 percent slopes. This very deep, moderately well drained soil is on uplands. It formed in loess. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface layer is brown silt loam 10 inches thick. The subsoil is pale brown silt loam 6 inches thick. The upper 6 inches of the next layer is very pale brown silt loam. The lower part, to a depth of 27 inches, is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Joel silt loam. Also included are small areas of a soil that is similar to this Taney soil but has a clayey buried subsoil.

Permeability of this Taney soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for woodland. A few areas are used for hayland, pastureland, and cropland.

The potential natural plant community is mainly Douglas-fir, ponderosa pine, common snowberry, and bluebunch wheatgrass. This unit is well suited to Douglas-fir and ponderosa pine.

The site index for Douglas-fir is about 100. This unit can produce about 7,100 cubic feet per acre of trees 0.6 inch or more in diameter or 26,000 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. After the timber is harvested, reforestation must be carefully managed to reduce competition from undesirable understory plants. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include bluebunch wheatgrass, elk sedge, bluegrass, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 15 to 20 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,800 pounds per acre to 400 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, and alfalfa.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent cover.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

53-Thatuna silt loam, 3 to 7 percent slopes. This very deep, moderately well drained soil is on low terraces. It formed in loess. The natural vegetation is mainly grasses. Elevation is about 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typically, the surface layer is dark grayish brown silt loam 20 inches thick. The subsoil is brown silt loam 13 inches thick. The next layer is light gray silt 6 inches thick. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Palouse and Latahco silt loams.

Permeability of this Thatuna soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the moderate hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility maintained by using a suitable cropping system, crop residue management, minimum tillage, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is suited to recreational development. It is limited mainly by a dusty surface layer.

If this unit is used for homesite development, the main limitations are the seasonal perched water table, slow permeability, and frost action. Septic tank absorption fields do not function properly late in winter and in spring. Buildings should be designed to offset the effects of the seasonal perched water table, and roads should be designed to offset the effects of frost action. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIe.

54-Thatuna-Naff silt loams, 25 to 40 percent slopes. This map unit is on north-facing slopes on uplands (fig. 8). The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 60 percent Thatuna silt loam and 30 percent Naff silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tilma silt loam. Also included are small areas of an eroded soil that is similar to the Naff and Thatuna soils but has a brown surface layer.

The Thatuna soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 20 inches thick. The subsoil is brown silt loam 13 inches thick. The next 6 inches is light gray silt. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Thatuna soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

The Naff soil is very deep and well drained. It formed in loess. Typically, the surface layer is very dark grayish brown silt loam 7 inches thick. The upper 40 inches of the subsoil is brown silty clay loam. The lower part to a depth of 60 inches or more is yellowish brown silty clay loam.

Permeability of the Naff soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high. The potential frost action is high.

This unit is used mainly for cropland. It is also used for hayland, pastureland, and wildlife habitat.

This unit is poorly suited to wheat and barley. It is limited mainly by the very high hazard of erosion and a hazard of soil slipping. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. The steeper areas may need to be seeded to permanent cover.

Figure 8.-Area of Thatuna-Naff silt loams, 25 to 40 percent slopes.

The hazard of soil slipping can be reduced by avoiding undercutting on toe slopes and by properly placing windbreaks to reduce snow drifting on the steeper slopes.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope and the seasonal perched water table. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass IVe.

55-Tilma-Garfield silt loams, 7 to 25 percent slopes. This map unit is on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 145 days.

This unit is about 50 percent Tilma silt loam and 25 percent Garfield silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Palouse and Naff silt loams. Also included are small areas of an eroded soil that is similar to the Tilma and Naff soils but has a brown surface layer.

The Tilma soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 11 inches thick. The subsoil is brown silt loam 9 inches thick. Next is a layer of light brownish gray silt loam 2 inches thick. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay.

Permeability of the Tilma soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The buried subsoil has high shrink-swell potential.

The Garfield soil is very deep and well drained. It formed in loess. Typically, the surface layer is brown silt loam 8 inches thick. The upper 14 inches of the subsoil is brown silty clay loam. The lower part to a depth of 60 inches or more is light yellowish brown silt loam.

Permeability of the Garfield soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The subsoil has high shrink-swell potential.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is moderately suited to wheat and barley. It is limited mainly by the high hazard of erosion, poor tilth, and low fertility. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures are needed to improve fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas may need to be seeded to permanent cover.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If the Tilma soil is used for homesite development, the main limitations are slope, the seasonal perched water table, slow permeability, and shrink-swell potential. If the Garfield soil is used for homesite and urban development, the main limitations are slope, slow permeability, and shrink-swell potential. Measures to control surface runoff and erosion are needed if the plant cover on these soils is disturbed or removed. The hazard of erosion is increased if the soils are left exposed during site development. Roads and buildings should be designed to conform to the landscape. Specially designed waste disposal systems are required.

Roads on the Tilma soil should be designed to offset the effects of slope and shrink-swell potential. Buildings should be designed to offset the effects of slope, the seasonal perched water table, and shrink-swell potential. Roads and buildings on the Garfield soils should be designed to offset the effects of slope and shrink-swell potential.

Topsoil should be stockpiled and used to reclaim areas of these soils disturbed during construction.

This map unit is in capability subclass IIIe.

56-Tilma-Naff silt loams, 7 to 25 percent slopes. This map unit is on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 50 percent Tilma silt loam and 35 percent Naff silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Palouse silt loam. Also included are small areas of an eroded soil that is similar to the Tilma and Naff soils but has a brown surface layer.

The Tilma soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 11 inches thick. The subsoil is brown silt loam 9 inches thick. Next is a layer of light brownish gray silt loam 2 inches thick. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay.

Permeability of the Tilma soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The buried subsoil has high shrink-swell potential.

The Naff soil is very deep and well drained. It formed in loess. Typically, the surface layer is very dark grayish brown silt loam 7 inches thick. The upper 40 inches of the subsoil is brown silty clay loam. The lower part to a depth of 60 inches or more is yellowish brown silty clay loam.

Permeability of the Naff soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is well suited to wheat, barley, peas, and lentils. It is limited mainly by the high hazard of erosion. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If the Tilma soil is used for homesite development, the main limitations are slope, the seasonal perched water table, slow permeability, and shrink-swell potential. If the Naff soil is used for homesite development, the main limitations are slope, moderately slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover on these soils is disturbed or removed. The hazard of erosion is increased if the soils are left exposed during site development. Roads and buildings should be designed to conform to the landscape. Specially designed waste disposal systems are required.

Buildings on the Tilma soil should be designed to offset the effects of slope, the seasonal perched water table, and shrink-swell potential, and roads should be designed to offset the effects of slope and shrink-swell potential. Buildings on the Naff soil should be designed to offset the effects of slope, and roads should be designed to offset the effects of slope and frost action.

Topsoil should be stockpiled and used to reclaim areas of these soils disturbed during construction.

This map unit is in capability subclass IIIe.

57-Tilma-Thatuna silt loams, 7 to 25 percent slopes. This map unit is on uplands. The natural vegetation is mainly grasses. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

This unit is about 50 percent Tilma silt loam and 30 percent Thatuna silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Naff silt loam. Also included are small areas of an eroded soil that is similar to the Tilma and Naff soils but has a brown surface layer.

The Tilma soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 11 inches thick. The subsoil is brown silt loam 9 inches thick. Next is a layer of light brownish gray silt loam 2 inches thick. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay.

Permeability of the Tilma soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The buried subsoil has high shrink-swell potential.

The Thatuna soil is very deep and moderately well drained. It formed in loess. Typically, the surface layer is dark grayish brown silt loam 20 inches thick. The subsoil is brown silt loam 13 inches thick. The next layer is light gray silt 6 inches thick. Below this is an older, buried subsoil. The buried subsoil to a depth of 60 inches or more is light yellowish brown silty clay loam.

Permeability of the Thatuna soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the buried subsoil early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is moderately well suited to wheat, barley, peas, and lentils. It is limited mainly by the high hazard of erosion and the seasonal perched water table. Erosion can be controlled and fertility and tilth maintained by using a suitable cropping system, crop residue management, minimum tillage, cross-slope farming, divided-slope farming or stripcropping, and proper fertilization. Tiling wet areas may be beneficial.

This unit is well suited to hay and pasture. The main limitations are slope and the hazard of water erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, intermediate wheatgrass, smooth brome, and alfalfa.

This unit is poorly suited to recreational development. It is limited mainly by slope.

If the Tilma soil is used for homesite development, the main limitations are slope, the seasonal perched water table, slow permeability, and shrink-swell potential. If the Thatuna soil is used for homesite development, the main limitations are slope, a seasonal perched water table, slow permeability, and frost action. Measures to control surface runoff and erosion are needed if the plant cover on these soils is disturbed or removed. The hazard of erosion is increased if the soils are left exposed during site development. Roads and buildings should be designed to conform to the landscape. Specially designed waste disposal systems are required.

Buildings on the Tilma soil should be designed to offset the effects of slope, the seasonal perched water table, and shrink-swell potential, and roads should be designed to offset the effects of slope and shrink-swell potential. Buildings on the Thatuna soil should be designed to offset the effects of slope and the seasonal perched water table, and roads should be designed to offset the effects of slope and frost action.

Topsoil should be stockpiled and used to reclaim areas of these soils disturbed during construction.

This map unit is in capability subclass IIIe.

58-Uvi loam, 5 to 20 percent slopes. This very deep, well drained soil is on mountain toe slopes and ridges. It formed in loess and in residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The upper 7 inches of the surface layer is brown and yellowish brown loam. The lower 11 inches is pale brown loam. The upper 10 inches of the subsoil is pale brown loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Included in this unit are small areas of Vassar silt loam and Spokane loam. Also included are small areas of a soil that is similar to this Uvi soil but has a clay loam subsoil.

Permeability of the Uvi soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for woodland. A few areas are used for hayland, pastureland, and cropland.

The potential natural plant community is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This unit is well suited to grand fir and Douglas-fir.

The site index for grand fir is about 55. This unit can produce about 8,400 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, bluegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per' acre to less than 300 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

This unit is suited to wheat and barley. It is limited mainly by the high hazard of erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Minimum tillage, cross-slope farming, divided slope farming or stripcropping, and proper fertilization are also needed. Steep areas or shallow and rocky areas may need to be seeded to permanent cover.

This unit is well suited to poorly suited to recreational development. It is limited mainly by slope.

If this unit is used for homesite development, the main limitation is slope. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soils are left exposed during site development. Roads and buildings should be designed to conform to the landscape and to offset the effects of slope. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass IIIe.

59-Uvi loam, 20 to 35 percent slopes. This very deep, well drained soil is on mountainsides. It formed in loess and in residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The upper 7 inches of the surface layer is brown and yellowish brown loam. The lower 11 inches is pale brown loam. The upper 10 inches of the subsoil is pale brown loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Included in this unit are small areas of Vassar silt loam and Spokane loam. Also included are small areas of a soil that is similar to this Uvi soil but has a clay loam subsoil.

Permeability of the Uvi soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

Most areas of this unit are used for woodland. A few areas are used for hayland and pastureland.

The potential natural plant community is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This unit is well suited to grand fir and Douglas-fir.

The site index for grand fir is about 55. This unit can produce about 8,400 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, bluegrass, and willow. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to less than 300 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly; however, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass IVe.

60-Uvi-Spokane association, very steep. This map unit is on mountainsides. The natural vegetation is mainly coniferous trees. Slope is 35 to 65 percent. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 26 inches, the average annual air temperature is about 45 degrees F, and the average frost-free period is about 115 days.

This unit is about 55 percent Uvi loam and 25 percent Spokane loam. The Uvi soil is mainly on smooth side slopes, and the Spokane soil is mainly on ridges.

Included in this unit are small areas of Vassar silt loam. Also included are small areas of Rock outcrop and a soil that is similar to the Uvi soil but has a clay loam subsoil.

The Uvi soil is very deep and well drained. It formed in loess and in residuum derived from granite. Typically, the surface is covered with a mat of organic material 2 inches thick. The upper 7 inches of the surface layer is brown and yellowish brown loam. The lower 11 inches is pale brown loam. The upper 10 inches of the subsoil is pale brown loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Permeability of the Uvi soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Spokane soil is moderately deep and well drained. It formed in loess and in residuum derived dominantly from granite. Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is brown loam 10 inches thick. The subsoil is light yellowish brown gravelly loam 5 inches thick. The substratum is light yellowish brown and pale brown gravelly coarse sandy loam 23 inches thick. Decomposing granite is at a depth of 38 inches.

Permeability of the Spokane soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community on the Uvi soil is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This soil is well suited to the production of grand fir and Douglas-fir.

The site index for grand fir on the Uvi soil is about 55. This soil can produce about 8,400 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees in 80 years.

The potential natural plant community on the Spokane soil is mainly Douglas-fir, ponderosa pine, common snowberry, and Idaho fescue. This soil is well suited to the production of Douglas-fir and ponderosa pine.

The site index for ponderosa pine on the Spokane soil is about 90. This soil can produce about 5,900 cubic feet per acre of trees 0.6 inch or more in diameter or 18,500 board feet of merchantable timber 11.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber on these soils are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. The steepness of slope limits the kinds of equipment that can be used in forest management. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soils protected by seeding disturbed areas to species such as orchardgrass, tall fescue, timothy, and white Dutch clover.

The important native understory forage plants on the Uvi soil are elk sedge, Columbia brome, bluegrass, and willow. This soil can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to less than 300 pounds per acre.

The important native understory forage plants on the Spokane soil are bluebunch wheatgrass, elk sedge, bluegrass, and rose. This soil can produce forage for livestock and big game animals for 20 to 25 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,700 pounds per acre to less than 400 pounds per acre.

Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

61-Uvi-Vassar association, very steep. This map unit is on mountainsides. The natural vegetation is mainly coniferous trees. Slope is 35 to 65 percent. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 36 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

This unit is about 60 percent Uvi loam and 25 percent Vassar silt loam. The Uvi soil is mainly on south-facing slopes, and the Vassar soil is mainly on north- and east-facing slopes.

Included in this unit are small areas of a soil that is similar to the Uvi soil but has a clay loam subsoil and a soil that is similar to the Vassar soil but is moderately deep to decomposing granite.

The Uvi soil is very deep and well drained. It formed in loess and in residuum derived from granite. Typically, the surface is covered with a mat of, organic material 2 inches thick. The upper 7 inches of the surface layer is brown and yellowish brown loam. The lower 11 inches is pale brown loam. The upper 10 inches of the subsoil is pale brown loam. The lower part to a depth of 60 inches or more is light yellowish brown loam.

Permeability of the Uvi soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Vassar soil is deep and well drained. It formed in volcanic ash over residuum derived from granite. Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 6 inches thick. The subsoil is light yellowish brown silt loam 18 inches thick. The upper 15 inches of the substratum is pale brown coarse sandy loam. The lower part is very pale brown loamy coarse sand 14 inches thick. Decomposing granite is at a depth of 53 inches.

Permeability of the Vassar soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community on the Uvi soil is mainly grand fir, Douglas-fir, mallow ninebark, and elk sedge. This soil is well suited to the production of grand fir and Douglas-fir.

The site index for grand fir on the Uvi soil is about 55. This soil can produce about 8,400 cubic feet per acre of trees 0.6 inch or more in diameter or 12,200 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The potential natural plant community on the Vassar soil is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This soil is well suited to the production of western redcedar, grand fir, and western white pine.

The site index for western white pine on the Vassar soil is about 75. This soil can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber on these soils are the hazard of water erosion, slope, and the hazard of plant competition. Minimizing the risk of erosion is essential in harvesting timber. Because the volcanic ash in the surface layer of the Vassar soil is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soils protected by seeding disturbed areas to species such as orchardgrass, tall fescue, timothy, and white Dutch clover.

The important native understory forage plants on the Uvi soil are elk sedge, Columbia brome, bluegrass, and willow. This soil can produce forage for livestock and big game animals for 10 to 15 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 1,900 pounds per acre to less than 300 pounds per acre.

The important native understory forage plants on the Vassar soil are elk sedge, Columbia brome, redstem ceanothus, willow, and rose. This soil can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,400 pounds per acre to less than 50 pounds per acre.

Management of the vegetation on this unit should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soils. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass Vlle.

62-Vassar silt loam, 5 to 20 percent slopes. This deep, well drained soil is mountain toe slopes. It formed in volcanic ash over .residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is about 2,800 to 4,500 feet. The average annual precipitation is about 45 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 75 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 6 inches thick. The subsoil is light yellowish brown silt loam 18 inches thick. The upper 15 inches of the substratum is pale brown coarse sandy loam. The lower part is very pale brown loamy coarse sand 14 inches thick. Decomposing granite is at a depth of 53 inches.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to this Vassar soil but is moderately deep to decomposing granite.

Permeability of this Vassar soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for woodland. A few areas are used for hayland and pastureland.

The potential natural plant community is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This unit is well suited to western redcedar, grand fir, and western white pine.

The site index for western white pine is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,400 pounds per acre to less than 50 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

This unit is very poorly suited to use as cropland because of the very high hazard of erosion. It should be maintained in permanent cover.

This unit is suited or poorly suited to recreational development. It is limited mainly by slope and the high hazard of erosion.

If this unit is used for homesite development, the main limitations are slope and rapid permeability. Measures to control surface runoff and erosion are needed if the plant cover is disturbed or removed. The hazard of erosion is increased if the soil is left exposed during site development. Roads and buildings should be designed to conform to the landscape. Slope and rapid permeability are concerns in installing septic tank absorption fields. Absorption lines should be installed on the contour. The substratum may be a poor filter. Buildings and roads should be designed to offset the effects of slope. Topsoil should be stockpiled and used to reclaim areas disturbed during construction.

This map unit is in capability subclass VIe.

63-Vassar silt loam, 20 to 35 percent slopes. This deep, well drained soil is mountain toe slopes and ridgetops. It formed in volcanic ash over residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 4,900 feet. The average annual precipitation is about 45 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 75 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 6 inches thick. The subsoil is light yellowish brown silt loam 18 inches thick. The upper 15 inches of the substratum is pale brown coarse sandy loam. The lower part is very pale brown loamy coarse sand 14 inches thick. Decomposing granite is at a depth of 53 inches.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to this Vassar soil but has a dark brown surface layer and soils that are moderately deep to decomposing granite.

Permeability of this Vassar soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This unit is well suited to western redcedar, grand fir, and western white pine.

The site index for western white pine is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, wetness, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The loss of the surface layer can result in a lower site index. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Use of equipment is limited when the soil is wet. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,400 pounds per acre to less than 50 pounds per acre.

This unit is well suited to hay and pasture. The main limitations are the hazard of erosion and slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Seedbed preparation should be on the contour or across the slope where practical. The addition of nitrogen and sulfur is essential, and phosphorus is also needed if legumes are grown. Among the suitable improved forage plants are latar orchardgrass, smooth brome, timothy, red clover, and alfalfa.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development, mainly because of the steepness of slope. Preparation of sites is costly. However, small included areas of less steeply sloping soils in this unit may be more suitable for use as homesites.

This map unit is in capability subclass VIe.

64-Vassar silt loam, 35 to 65 percent slopes. This deep, well drained soil is on mountainsides. It formed in volcanic ash over residuum derived dominantly from granite. The natural vegetation is mainly coniferous trees. Elevation is 2,800 to 4,983 feet. The average annual precipitation is about 45 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 75 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The surface layer is yellowish brown silt loam 6 inches thick. The subsoil is light yellowish brown silt loam 18 inches thick. The upper 15 inches of the substratum is pale brown coarse sandy loam. The lower part is very pale brown loamy coarse sand 14 inches thick. Decomposing granite is at, a depth of 53 inches.

Included in this unit are small areas of Uvi loam. Also included are small areas of a soil that is similar to this Vassar soil but has a dark brown surface layer and soils that are moderately deep to decomposing granite.

Permeability of this Vassar soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for woodland.

The potential natural plant community is mainly western redcedar, western white pine, pachystima, and mountain blueberry. This unit is well suited to western redcedar, grand fir, and western white pine.

The site index for western white pine is about 75. This unit can produce about 11,000 cubic feet per acre of trees 0.6 inch or more in diameter or 42,600 board feet of merchantable timber 12.6 inches or more in diameter. Potential production is from an unmanaged stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of water erosion, slope, and the hazard of plant competition. Because the volcanic ash in the surface layer is highly erodible, very careful management of timber is needed to minimize the risk of water erosion. The possible loss of the surface layer can result in a lower site index. The steepness of slope limits the kinds of equipment that can be used in forest management. To avoid excessive erosion, construction and maintenance of logging roads, skid trails, and landings should be carefully planned. If site preparation is not adequate, competition from undesirable plants can prolong natural or artificial reestablishment of trees.

This unit is suited to grazing when the tree canopy is opened by logging, fire, or other disturbance. Forage production can be increased and the soil protected by seeding disturbed areas to adapted species such as orchardgrass, timothy, tall fescue, and white Dutch clover. When the canopy is sparse or open, the important native understory forage plants on this unit include elk sedge, Columbia brome, redstem ceanothus, willow, and rose. Management of the vegetation should be designed to encourage the regeneration of timber and to ensure that there is adequate litter to protect the soil. The very steep slopes limit the movement of livestock and the accessibility of forage.

This unit can produce forage for livestock and big game animals for 5 to 10 years after the tree canopy is opened. During this period, total annual production of air-dry forage will vary from 2,400 pounds per acre to less than 50 pounds per acre.

This unit is poorly suited to recreational development. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This unit is poorly suited to homesite development. The main limitation is slope.

This map unit is in capability subclass VIIe.

65-Westlake-Latahco silt loams, 0 to 3 percent slopes. This map unit is on valley floors (fig. 9). The natural vegetation is mainly grasses. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

This unit is about 55 percent Westlake silt loam and 35 percent Latahco silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Latah silt loam. Also included are small areas of a soil that is similar to the Westlake soil but has layers of loam and sandy loam 30 to 60 inches thick.

The Westlake soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the upper 18 inches of the surface layer is dark gray silt loam. The lower 15 inches is grayish brown silt loam. The upper 16 inches of the underlying material is light brownish gray silt loam. The lower part to a depth of 60 inches or more is very pale brown silt loam.

Figure 9. -Area of Westlake-Latahco silt loams, 0 to 3 percent slopes, in foreground. Palouse silt loam, 7 to 25 percent slopes in background.

Permeability of the Westlake soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 6 to 18 inches late in winter and in spring. This soil is subject to frequent, brief periods of flooding in winter and early in spring. The potential frost action is high.

The Latahco soil is very deep and somewhat poorly drained. It formed in alluvium derived dominantly from loess. Typically, the upper 14 inches of the surface layer is dark gray silt loam. The lower 6 inches is grayish brown silt loam. The upper 4 inches of the subsurface layer is light brownish gray silt loam. The lower part, to a depth of 28 inches, is light gray silt. The upper 18 inches of the subsoil is light brownish gray silty clay loam. The lower part to a depth of 60 inches or more is light gray silty clay loam.

Permeability of the Latahco soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is none to slight. Water is perched above the subsoil in spring. This soil is subject to occasional, brief periods of flooding in winter and early in spring. The potential frost action is high.

Most areas of this unit are used for cropland. A few areas are used for hayland and pastureland.

This unit is suited to wheat and barley. It is limited mainly by the seasonal high water table. Proper drainage is necessary. A suitable cropping system, crop residue management, and proper fertilization help to maintain soil fertility and tilth.

This unit is well suited to hay and pasture. The main limitation is wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Fertilizer is needed to ensure optimum growth of grasses and legumes. Among the suitable improved forage plants are timothy, tall fescue, meadow foxtail, red clover, and alsike clover.

This unit is poorly suited to recreational development. It is limited mainly by the seasonal high water table and the hazard of flooding.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the seasonal high water table, moderately slow permeability, and frost action. Roads should be designed to offset the effects of flooding, wetness, and frost action.

This map unit is in capability subclass IVw.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland and native grazing land; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can also use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, and trees and shrubs.

Crops and pasture

By Harry J. Riehle, agronomist, Soil Conservation Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soils maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 271,000 acres in the survey area is used as cropland, which includes hayland and pastureland. The major crops are winter wheat, dry peas, barley, lentils, oats, and hay. The most productive cropland soils are those of the Palouse series.

The topography of the area contributes to a serious hazard of erosion, especially in steep concave areas on north-facing slopes where drifted snow collects. The cropland that extends into the cutover timbered soils is more severely limited as to crops that can be grown, tillage practices that can be used, and other management considerations. Much of the cutover area is used for pasture and hayland.

Appropriate cropland management is vital to the effective control of erosion. Annual cropping, minimum tillage, cross-slope farming, divided-slope farming, and critical area seeding are important to the success of any cropping system. In addition, such practices as waterways, diversions, and tile lines can be used where needed.

About 60,000 acres of the soils in the survey area has been identified as prime farmland. The soils that make up this acreage are the Athena, Palouse, Hampson, Taney, and Thatuna soils; the Larkin and Southwick silt loams that have slopes of less than 7 percent; and the Latah, Latahco, Lovell, and Westlake soils that have slopes of 0 to 3 percent.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields .may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible soil loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (10). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s, or c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s, or c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Woodland management and productivity

By Donald S. Larson, woodland conservationist, Soil Conservation Service.

Latah County Area's woodland resource has been a major economic factor for more than 100 years. Pioneer farmers began by clearing forested land on the eastern side of the county and using the logs and lumber as building materials. Around the turn of the century the lumber industry began extensive operations in the northern, northeastern, and eastern parts of the area. Today, about 115,000 acres in the county is privately owned woodland. The woodland is owned by about 1,400 individuals and corporations. In addition, about 81,000 acres is administered by federal and state agencies.

Four lumber mills are in the area, and several independent logging operators keep the mills supplied with logs from state and national forest land and from private woodland. The University of Idaho, College of Forestry, Wildlife and Range Sciences, located at Moscow, assists the forest industry through its research programs and extension services.

Several commercially valuable species of tree are produced on the woodland soils in the area. Ponderosa pine and Douglas-fir are the main lumber producing species, although grand fir, larch, western white pine, western redcedar, and lodgepole pine also are important.

The soil survey provides the woodland owners or managers with information designed to help them recognize the productive capacity of the soil in relation to its ability to produce trees that are best suited to the soil. It also provides them with information concerning the soil-related hazards or limitations when using the soil for timber management and production. Each hazard or limitation statement is meant to give owners or managers a general knowledge of their soils as it pertains to timber management. For assistance concerning a specific limitation or management practice, owners or managers should seek professional guidance.

Within each woodland discussion of the map unit descriptions the reader will find yield, or production, statements for the major tree species. This information is based upon total growth over a period of 80 years and is given in cubic feet per acre and board feet per acre (Scribner rule). Yield in cubic feet per acre includes that for all trees 0.6 inch in diameter and larger. Yield in board feet per acre for ponderosa pine and Douglas-fir includes that for all trees 11.6 inches in diameter or larger. Yield for grand fir and western white pine includes that for all trees 12.6 inches in diameter or larger. All diameters are measured 4.5 feet above the ground.

If the woodland manager has planned the harvest, or cutting, rotation over a longer period of time, more than

80 years, he will have larger yields than those shown in the map units. On certain soils that support grand fir and western white pine with a low site index, providing an additional 10 years in the harvest rotation will substantially increase the volume of timber produced.

Table 6 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the ordination symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w,* excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *x, w, t, d, c, s, f, and r.*

In table 6, *slight, moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or common trees on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

The volume yields for ponderosa pine and Douglas-fir were determined from the table in U.S.D.A. Technical Bulletin 630 (6). Volume yields for grand fir and western white pine were determined from the tables in U.S.D.A. Technical Bulletin 323 (3).

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 7 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 7 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Native grazing land

By Dennis K. Froeming, range conservationist, Soil Conservation Service.

About 196,000 acres of native grazing land is in the survey area. Of this total, about 15,000 acres is rangeland and 181,000 acres is grazable woodland, which is discussed in the section "Woodland understory vegetation." About 5 percent of the agricultural income of the survey area is from the sale of livestock products.

The rangeland is mainly in the canyon adjacent to the lower part of the Potlatch River and it tributaries. It is mainly on south-facing slopes. The grazable woodland is in the open forested areas and where timber harvesting, fire, or other disturbance has opened the forest canopy sufficiently to allow the production of understory vegetation.

Cow and calf operations are the primary type of operation, although some calves are held over or are purchased to be sold as yearlings. The average size of the ranches is about 1,000 acres. Typically, there is a winter feeding period of 5 or 6 months. Feed for winter is usually produced on farms. Those few livestock operations that have canyon rangeland available can shorten the winter feeding period to 3 or 3 1/2 months. The grazing season begins early in April on the rangeland and lasts until mid-December. Grazing on the forested land begins in mid-May and lasts until late in October. Most livestock spend summer and fall on forested range. Calving usually occurs from late in January until early in March.

The natural vegetation on much of the rangeland has been largely depleted by continuous heavy use early in spring since the 1880's. Much of the original bluebunch wheatgrass and Idaho fescue has been replaced by annual bromegrasses and sod-forming bluegrasses.

The amount of forage produced in the woodland areas depends mainly on the amount of light that reaches the forest floor. After logging or fire, there is a large increase in the production of understory vegetation for a number of years. As the canopy closes, the understory production decreases. In many areas the diversity of the tree canopy in the potential plant community allows only sparse production of understory vegetation.

The major management concern on most grazing land is control of grazing so that desired kinds and amounts of plants are established or maintained. On rangeland this is normally the reestablishment of the potential natural plant community. On grazable woodland it is maintaining the desired forage plants and reestablishing and protecting the desired timber species. In both situations the basic principles of range and plant management need to be applied. The physiological requirements of the plants for growth, maintenance, and reproduction must be met if the more desirable species are to be established or maintained.

The management practices most effective in meeting the plant needs are use of a planned grazing system, delaying grazing in spring until plant growth is well started, and proper use. In addition, the management should be based on soil survey information and other inventory information to meet the vegetative management objectives.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing. on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat; and protects soil and water resources.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help, to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8. are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

By Kenneth T. Wotring, soil scientist, Soil Conservation Service.

The survey area provides an abundance of opportunities for year-round outdoor recreation, including hunting, fishing, camping, and winter sports.

Wildlife species that provide hunting in fall include white-tailed deer, elk, black bear, and game birds such as Hungarian partridge, valley quail, chukar, ring-necked pheasant, and grouse. Fishing is limited to Spring Valley Reservoir, some small streams, and private farm ponds.

Local camp areas are McCroskey State Park, northwest of Potlatch; Laird Park and Camp Grizzly, near Harvard; and Little Boulder Creek Campground, south of Helmer.

There are two areas for downhill skiing, one north of Harvard, just outside the survey area, and one north of Troy. A large part of the survey area offers opportunities for cross-country skiing and snowmobiling.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation; by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated *good, fair, poor, or very poor*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are *severe* for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and Columbia brome.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees; shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, spruce, Douglas-fir, and western redcedar.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are redstem ceanothus, baldhip rose, pachystima, and serviceberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are sedges, rushes, common camas, and tufted hairgrass.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include valley quail, ring-necked pheasant, Hungarian partridge, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include white-tailed deer, black bear, and elk.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks and muskrat.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include mule deer, chukars, and hawks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered slight if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and severe if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill-trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills: Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction prac tices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated fair are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated poor have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and grave/ are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered slight if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index.

Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A1-a, A-1-b, A-2-4, A-25, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are low, a change of less than 3 percent; moderate, 3 to 6 percent; and *high,* more than 6 percent. Very *high,* greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; occasional that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as very *brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic. matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table-that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost. action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (11). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xeroll (*Xer*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argixerolls (Argi, meaning accumulation of clay in the subsoil, plus xeroll, the suborder of the Mollisols that have a dry moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind. of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective Ultic identifies the subgroup that has lower base saturation than is typical for the great group. An example is Ultic Argixerolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Ultic Argixerolis.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series and soil variant recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (9). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (11). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series and soil variant are described in the section "Soil maps for detailed planning."

Agatha series

The soils in the Agatha series are loamy-skeletal, mixed, frigid Ultic Haploxeralfs.

These deep, well drained soils are on north-facing slopes of canyons. The soils formed in loess and in material weathered from basalt. Slope is 35 to 65 percent. Elevation is 2,200 to 2,800 feet. The average annual precipitation is about 27 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Agatha gravelly silt loam, 35 to 65 percent slopes, about 1,970 feet south and 1,400 feet west of the northeast corner of sec. 18, T. 39 N., R. 3 W.

O1-1 inch to 0; decomposed organic material.

A1-0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many fine interstitial pores; 5 percent gravel; neutral; clear smooth boundary.

A3-3 to 7 inches; brown (7.5YR 5/4) gravelly silt loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many fine tubular pores; 20 percent gravel and 10 percent cobblestones; slightly acid; clear wavy boundary.

B1t-7 to 18 inches; light brown (7.5YR 6/4) very gravelly silt loam, dark brown (7.5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many fine tubular pores; 30 percent gravel and 10 percent cobblestones; few moderately thick clay films lining pores; few clean silt grains on faces of peds; slightly acid; gradual wavy boundary.

B2t-18 to 42 inches; light brown . (7.5YR 6/4) very cobbly silty clay loam, dark brown (7.5YR 3/4) moist; moderate fine angular blocky structure; very hard, friable, sticky and plastic; common fine and medium roots; many fine tubular pores; 40 percent cobblestones and 20 percent gravel; common moderately thick clay films lining. pores and on faces of peds; few clean silt grains on faces of peds; common fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; gradual wavy boundary.

B3t-42 to 58 inches; light brown (7.5YR 6/4) very cobbly silty clay loam, dark brown (7.5YR 3/5) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many fine tubular pores; 30 percent cobblestones and 30 percent gravel; many thick clay films lining pores and on faces of peds; many clean silt grains on faces of peds; common fine iron and manganese concretions less than 1 millimeter in diameter; medium acid; abrupt wavy boundary.

R-58 inches; basalt.

The thickness of the solum and depth to bedrock range from 40 to 60 inches. The A horizon is 5 to 13 inches thick. It has hue of 7.5YR or 10YR and chroma of 3 or 4. It is 15 to 25 percent gravel and 0 to 10 percent cobblestones. It is slightly acid or neutral. The B2t horizon has value of 5 or 6 and chroma of 3 or 4. In the upper 20 inches it is 20 to 55 percent gravel and 10 to 40 percent cobblestones. It is slightly acid or medium acid. It has base saturation of less than 75 percent in at least some part.

Athena series

The soils in the Athena series are fine-silty, mixed, mesic Pachic Haploxerolls.

These very deep, well drained soils are on uplands. The soils formed in loess. Slope is 3 to 25 percent. Elevation is about 2,700 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 150 days.

Typical pedon of Athena silt loam, 3 to 7 percent slopes, about 1,340 feet west and 200 feet north of the southeast corner of sec. 12, T. 37 N., R. 6 W.

Ap-0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral; abrupt wavy boundary.

A12-6 to 12 inches;. very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear wavy boundary.

A3-12 to 17 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine interstitial pores; neutral; clear wavy boundary.

B1-17 to 30 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; neutral; clear wavy boundary.

B21-30 to 41 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; mildly alkaline; gradual wavy boundary.

B22-41 to 50 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few fine roots; many fine tubular pores; mildly alkaline; abrupt wavy boundary.

C-50 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 3/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; neutral; slightly calcareous.

The upper 30 inches of the profile has base saturation of more than 75 percent. The A horizon is 15 to 20 inches thick. It has value of 3 or 4. It is neutral or slightly acid. The B2 horizon is 15 to 25 inches thick. It has value of 4 or 5 and chroma of 3 or 4. It is neutral or mildly alkaline. The B2 horizon is silt loam and is 18 to 25 percent clay. It is calcareous between depths of 43 and 60 inches in most pedons.

Bluesprin series

The soils in the Bluesprin series are loamy-skeletal, mixed, mesic Ultic Argixerolls.

These moderately deep, well drained soils are on south-facing slopes of canyons. The soils formed in loess and residuum derived from basalt. Slope is 35 to 65 percent. Elevation is 1,000 to 2,600 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 160 days.

Typical pedon of a Bluesprin gravelly silt loam in an area of Bluesprin-Flybow complex, 35 to 65 percent slopes, about 950 feet east and 600 feet north of the southwest corner of sec. 18, T. 38 N., R. 2 W.

A11-0 to 3 inches; dark brown (10YR 4/3) gravelly silt loam, very dark brown (10YR 2/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; 15 percent gravel; neutral; clear smooth boundary.

A12-3 to 11 inches; dark brown (10YR 4/3) gravelly silt loam, very dark brown (10YR 2/3) moist; moderate fine subangular blocky structure parting to moderate fine granular; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; 25 percent gravel; slightly acid; clear wavy boundary.

B21t-11 to 15 inches; dark brown (10YR 4/3) very gravelly silty clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine and fine roots and common medium roots; common fine tubular pores; 30 percent gravel and 10 percent cobblestones; many moderately thick clay films on faces of peds; neutral; gradual wavy boundary.

B22t-15 to 24 inches; dark brown (10YR 4/3) very gravelly silty clay loam, dark yellowish brown (10YR 3/4) moist; strong fine subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; common fine tubular pores; 40 percent gravel and 20 percent cobblestones; many moderately thick clay films on faces of peds; slightly acid; clear wavy boundary.

R-24 inches; basalt.

The thickness of the solum and depth to bedrock range from 20 to 40 inches. The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 10 to 15 inches thick. It has chroma of 2 or 3. This horizon is 15 to 30 percent gravel and 0 to 5 percent cobblestones. It is slightly acid or neutral. The B horizon is 10 to 25 inches thick. It has value of 4 or 5 and chroma of 3 or 4. It is 20 to 40 percent gravel and 15 to 30 percent cobblestones.

Crumarine series

The soils in the Crumarine series are coarse-loamy, mixed, nonacid, frigid Aquic Xerofluvents.

These very deep, somewhat poorly drained soils are on valley floors. The soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Elevation is about 2,800 feet. The average annual ,precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Crumarine silt loam, 0 to 3 percent slopes, about 1,620 feet east and 1,220 feet north of the southwest corner of sec. 9, T. 40 N., R. 2 W.

O1-1 inch to 0; fresh and partially decomposed organic material.

A1-0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 3/3) moist; many fine and medium faint mottles; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many fine interstitial pores; medium acid; clear smooth boundary.

B2-4 to 9 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; many fine and medium faint mottles; weak fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; medium acid; clear wavy boundary.

C1-9 to 23 inches; very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; many fine and medium faint mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and common medium roots; many fine irregular pores; medium acid; gradual wavy boundary.

C2-23 to 30 inches; very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; common fine and medium prominent mottles; massive; hard, firm, nonsticky and nonplastic; few fine and common medium roots; many fine irregular pores; slightly acid; clear wavy boundary.

C3-30 to 46 inches; very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 4/3) moist; many medium prominent mottles; massive; hard, friable, nonsticky and nonplastic; few fine and medium roots; common fine irregular pores; 10 percent cobblestones and 20 percent gravel; medium acid; gradual wavy boundary.

C4-46 to 60 inches; very pale brown (10YR 7/3) very gravelly loamy sand, brown (10YR 4/3) moist; many fine and medium prominent mottles; massive; slightly hard, friable, nonsticky and nonplastic; few medium roots; few fine irregular pores; 15 percent cobblestones and 35 percent gravel; medium acid.

The C3 and C4 horizons are 0 to 40 percent gravel and 0 to 15 percent cobblestones. The profile is slightly acid or medium acid.

Driscoll series

The soils in the Driscoll series are fine, montmorillonitic, mesic Ultic Palexerolls.

These very deep, moderately well drained soils are on uplands. The soils formed in loess. Slope is 7 to 25 percent. Elevation is about 2,600 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typical pedon of a Driscoll silt loam in an area of Driscoll-Larkin silt loams, 7 to 25 percent slopes, about 1,470 feet east and 820 feet north of the southwest corner of sec. 25, T. 39 N., R. 5 W.

O11-2.5 inches to 1 inch; undecomposed organic material.

O12-1 inch to 0; partially decomposed organic material.

A11-0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; neutral; clear wavy boundary.

A12-2 to 6 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine continuous tubular pores; a 2-inch krotovina; neutral; clear wavy boundary.

A13-6 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few medium and coarse roots; many very fine and fine tubular pores; a 3-inch krotovina; neutral; gradual wavy boundary.

B1t-15 to 25 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to weak fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine tubular pores and common medium tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; few thin clay films on faces of peds; slightly acid; gradual wavy boundary.

B2t-25 to 31 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores and common medium continuous tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; few thin clay films on faces of peds; medium acid; clear wavy boundary.

A2-31 to 33 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many very fine and fine continuous tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; abrupt smooth boundary.

B21tbcn-33 to 45 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine continuous tubular pores; prisms are capped with A2 material; continuous thick dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; gradual wavy boundary.

B22tbcn-45 to 56 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine continuous tubular pores; continuous thick dark brown (7.5YR 4/4) clay films on faces of peds and in pores; many fine iron and manganese concretions less than 2 millimeters in diameter; neutral; clear wavy boundary.

B3tb-56 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure; very hard, very firm, sticky and plastic; few fine roots on faces of peds; many very fine and fine continuous tubular pores; continuous moderately thick dark brown (7.5YR 4/4) clay films on faces of peds and in pores; red stains on faces of peds; neutral.

The A horizon is 10 to 20 inches thick. It has value of 4 or 5 and chroma of 2 or 3. It is slightly acid or neutral. The B21t horizon is 10 to 25 inches thick. It has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 or 5. It is slightly acid or medium acid. This horizon is silty clay loam that is more than 35 percent clay, or it is silty clay. It has base saturation of less than 75 percent in at least some part of the upper 20 inches.

Farber series

The soils in the Farber series are loamy-skeletal, mixed, mesic Dystric Xerochrepts.

These very deep, well drained soils are on mountainsides. The soils formed in loess and in residuum and colluvium derived dominantly from metasedimentary rock. Slope is 35 to 65 percent. Elevation is 2,700 to 3,900 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 130 days.

Typical pedon of a Farber silt loam in an area of Farber-Minaloosa association, very steep, about 2,300 feet south and 1,320 feet west of the northeast corner of sec. 19, T. 43 N., R. 4 W.

O1-0.5 inch to 0; undecomposed and partially decomposed organic material.

A11-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine and common medium roots; common fine interstitial pores; trace of gravel; neutral; clear wavy boundary.

A12-7 to 11 inches; brown (10YR 5/3) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine tubular pores; 10 percent gravel; slightly acid; clear smooth boundary.

B1-11 to 16 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots and few medium and coarse roots; common fine and very fine tubular pores; 20 percent gravel; slightly acid; clear wavy boundary.

B21-16 to 26 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine and very fine roots and few medium and coarse roots; common fine and very fine tubular pores; 35 percent gravel; medium acid; gradual wavy boundary.

B22t-26 to 38 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium tubular pores; 45 percent gravel; few thin clay films; medium acid; gradual wavy boundary.

B23t-38 to 44 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; common fine and medium tubular pores; 50 percent gravel; few thin clay films; medium acid; gradual wavy boundary.

B3-44 to 60 inches; brown (7.5YR 5/4) extremely cobbly loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; no roots; 30 percent cobblestones and 40 percent gravel; medium acid.

Between depths of 10 and 40 inches, the profile is 35 to 55 percent gravel and 0 to 5 percent cobblestones. Between depths of 10 and 30 inches, it has base saturation of 40 to 60 percent. The A horizon is 8 to 14 inches thick. It has value of 4 or 5 and chroma of 2 or 3. It is 0 to 15 percent gravel. It is slightly acid or neutral. The B2t: horizon is 20 to 35 inches thick. It has hue of 7.5YR or 10YR and value of 5 or 6. It has less than 1.2 times as much clay as the overlying eluvial horizon.

Flybow series

The soils in the Flybow series are loamy-skeletal, mixed, nonacid, mesic Lithic Xerorthents.

These very shallow, well drained soils are on south-facing slopes of canyons. The soils formed in residuum derived dominantly from basalt. Slope is 35 to 65 percent. Elevation is 1,000 to 2,600 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 160 days.

Typical pedon of a Flybow very cobbly loam (fig. 10) in an area of Bluesprin-Flybow complex, 35 to 65 percent slopes, about 720 feet north and 100 feet west of the southeast corner of sec. 9, T. 38 N., R. 2 W.

A1-0 to 4 inches; strong brown (7.5YR 4/6) very cobbly loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine interstitial pores; 20 percent gravel and 35 percent cobblestones; slightly acid; abrupt wavy boundary.

R-4 inches; basalt.

The thickness of the solum and depth to bedrock range from 4 to 10 inches. The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is 25 to 50 percent gravel and 20 to 40 percent cobblestones. It is medium acid to neutral.

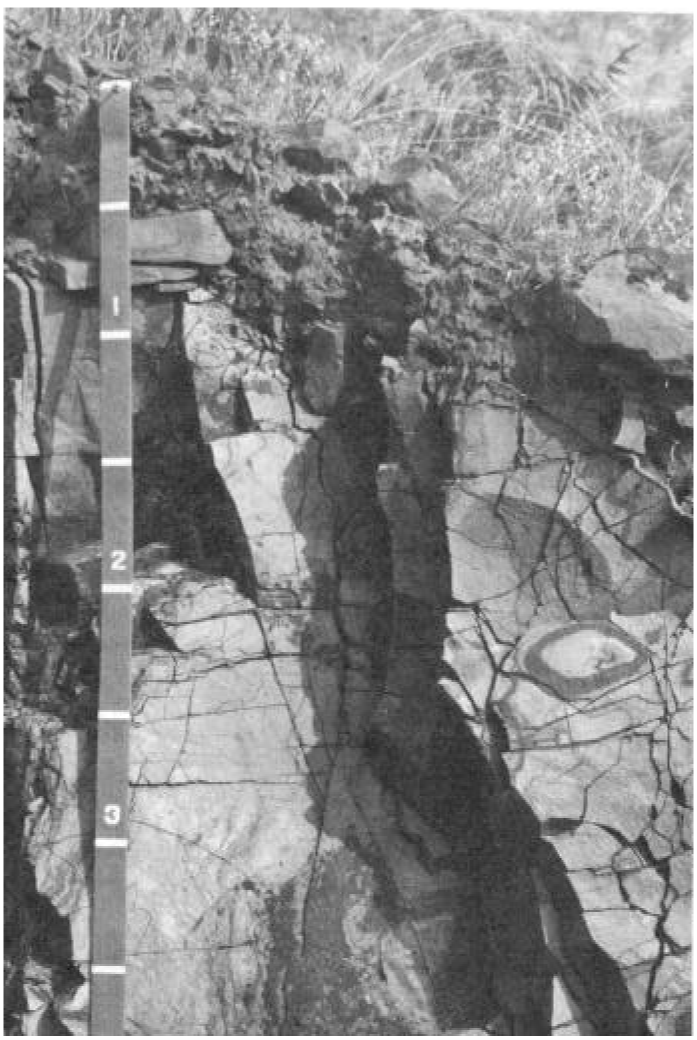


Figure 10.-Profile of Flybow very cobbly loam in an area of Bluesprin-Flybow complex, 35 to 65 percent slopes. Bedrock is at a depth of 4 to 10 inches.

Garfield series

The soils in the Garfield series are fine, mixed, mesic Mollic Haploxeralfs.

These very deep, well drained soils are on long, narrow ridges on uplands. The soils formed in loess. Slope is 3 to 30 percent. Elevation is about 2,800 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 150 days.

Typical pedon of a Garfield silt loam in an area of Tilma-Garfield silt loams, 7 to 25 percent slopes, about 1,020 feet south and 780 feet east of the northwest corner of sec. 8, T. 37 N., R. 4 W.

Ap-0 to 8 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine interstitial pores; few medium and coarse pieces of B material; neutral; abrupt smooth boundary.

B21t-8 to 15 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; few fine and very fine tubular pores; common moderately thick clay films on faces of pads and in pores; neutral; clear wavy boundary.

B22t-15 to 22 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak medium and coarse angular blocky structure; very hard, very firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; common moderately thick clay films on faces of pads and in pores; neutral; gradual wavy boundary.

B31t-22 to 53 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, slightly sticky and slightly plastic; no roots; common fine and very fine tubular pores; few thin clay films; few lime veins; moderately alkaline; clear smooth boundary.

B32t-53 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, slightly sticky and slightly plastic; no roots; few fine and very fine tubular pores; few thin clay films; moderately alkaline.

The Ap horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. It is slightly acid or neutral. The B21t horizon is silty clay loam that is more than 35 percent clay, or it is silty clay. It has hue of 7.5YR or 10YR and chroma of 3 or 4. It has more than 75 percent base saturation. Calcium carbonate is absent in some pedons.

These soils are taxadjuncts to the Garfield series because the argillic horizon is less than 36 inches thick.

Hampson series

The soils in the Hampson series are coarse-silty, mixed, frigid Fluventic Haploxerolls.

These very deep, moderately well drained soils are on valley floors. The soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Elevation is about 2,500 feet. The average annual precipitation is about 25 inches, the average annual air. temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Hampson silt loam, 0 to 3 percent slopes, about 1,800 feet west and 360 feet south of the northeast corner of sec. 8, T. 41 N., R. 4 W.

Ap-0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine interstitial pores; slightly acid; abrupt smooth boundary.

A12-7 to 11 inches; gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly acid; clear wavy boundary.

A13-11 to 18 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores, common medium tubular pores, and few coarse tubular pores that are vertically oriented; neutral; clear wavy boundary.

A14-18 to 28 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure; hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores, common medium tubular pores, and few coarse tubular pores that are vertically oriented; neutral; gradual wavy boundary.

C1-28 to 36 inches; light gray (10YR 7/2) loam, brown (10YR 4/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores, common medium tubular pores, and few coarse tubular pores that are vertically oriented; neutral; clear wavy boundary.

C2-36 to 60 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; many medium distinct mottles; massive; very hard, friable, sticky and plastic; no roots; many very fine tubular pores and few coarse tubular pores that are vertically oriented; neutral.

The solum is 10 to 30 inches thick. The profile is slightly acid or neutral. The Ap horizon has value of 4 or 5 and chroma of 1 or 2. In the upper 20 inches of the profile; organic carbon content decreases irregularly with depth. The C horizon has value of 6 or 7 and chroma of 2or3.

Helmer series

The soils in the Helmer series are medial, frigid Andic Fragiochrepts.

These very deep, moderately well drained soils are on uplands. The soils formed in volcanic ash that is underlain by loess. Slope is 5 to 35 percent. Elevation is about 2,900 feet. The average annual precipitation is about 33 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

Typical pedon of Helmer silt loam, 5 to 20 percent slopes, about 2,490 feet south and 400 feet east of the northwest corner of sec. 33, T. 41 N., R. 2 W.

O1-2 inches to 0.5 inch; undecomposed and slightly decomposed organic material.

O2-0.5 inch to 0; decomposed organic material.

B21ir-0 to 3 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 3/3) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine interstitial pores; neutral; clear wavy boundary.

B22ir-3 to 10 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots and common medium and coarse roots; many very fine and fine interstitial pores; neutral; gradual wavy boundary.

B23ir-10 to 16 inches; brown (7.5YR 5/4) silt loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine and very fine tubular pores; medium acid; abrupt wavy boundary.

IIA2-16 to 27 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common fine tubular pores; common fine black iron and manganese concretions less than 2 millimeters in diameter; medium acid; clear wavy boundary.

IIB&Ax-27 to 37 inches; B part is reddish yellow (7.5YR 6/6) silt loam, yellowish brown (10YR 5/4) moist; A part is very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; moderate medium prismatic structure parting to weak fine angular blocky; very hard, very firm, slightly sticky and slightly plastic; few fine roots on faces of prisms; common fine tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; abrupt smooth boundary.

IIBx2t-37 to 53 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse prismatic structure parting to weak fine angular blocky; extremely hard, extremely firm, sticky and plastic; few fine roots on faces of prisms; common fine and medium tubular pores; many thick clay films on faces of prisms and in pores; few fine iron and manganese concretions 1 to 3 millimeters in diameter; dark organic stains on faces of prisms; few uncoated silt grains on faces of prisms; strongly acid; clear wavy boundary.

IIBx3t-53 to 60 inches; strong brown (7.5YR 5/6) silt loam, dark brown (7.5YR 4/4) moist; weak very coarse prismatic structure parting to weak fine angular blocky; very hard, very firm, sticky and plastic; few fine roots on faces of prisms; common fine and medium tubular pores; common moderately thick clay films on faces of prisms; few fine iron and manganese concretions 1 to 3 millimeters in diameter; dark organic stains on faces of prisms; few uncoated silt grains on faces of prisms; strongly acid.

The IIA2 horizon is silt loam or silt. The B2ir horizon is 14 to 20 inches thick. It has hue of 7.5YR or 10YR and value of 5 or 6. It is medium acid to neutral. It has bulk density of less than 0.95.

These soils are taxadjuncts to the Helmer series because they have contrasting particle size classes within the control section.

Huckleberry series

The soils in the Huckleberry series are medial over loamy-skeletal, mixed Entic Cryandepts.

These moderately deep, well drained soils are on mountainsides. The soils formed in volcanic ash that is underlain by residuum and colluvium derived dominantly from metasedimentary rock. Slope is 35 to 65 percent. Elevation is 2,800 to 4,300 feet. The average annual precipitation is about 32 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 80 days.

Typical pedon of a Huckleberry silt loam in an area of Minaloosa-Huckleberry association, very steep (fig. 11), about 2,500 feet north and 1,900 feet east of the southwest corner of sec. 18, T. 43 N., R. 4 W.

O2-0.5 inch to 0; decomposed organic material.

B21 ir-0 to 5 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many fine interstitial pores; 5 percent gravel; slightly acid; clear wavy boundary.

B22ir-5 to 15 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure parting to moderate very fine granular; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots and common coarse roots; many fine interstitial pores; 5 percent gravel; slightly acid; abrupt wavy boundary.

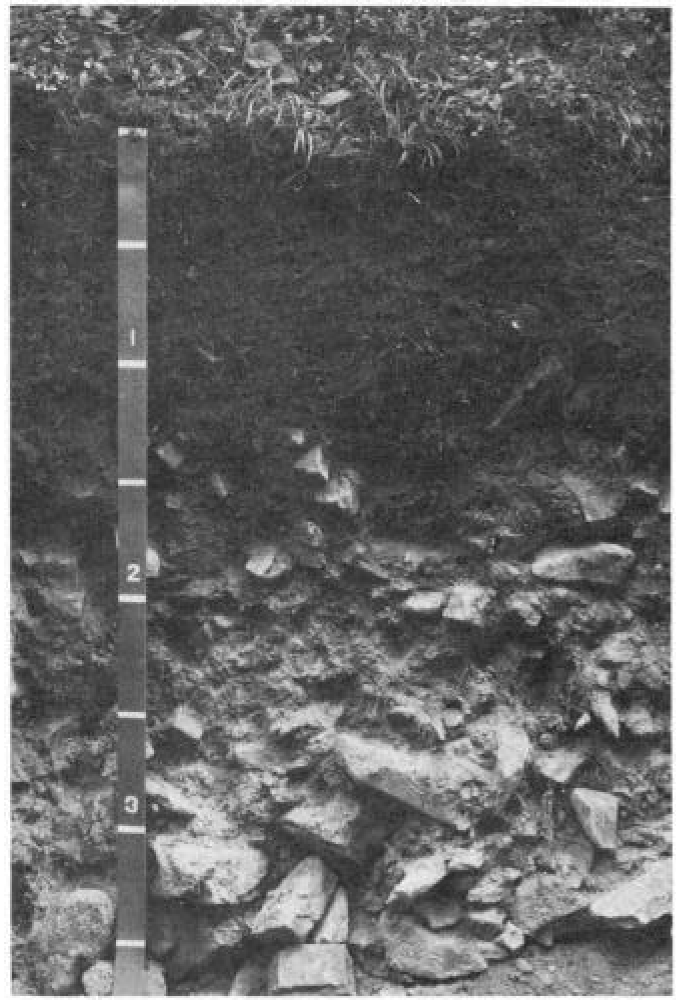


Figure 11. -Profile of Huckleberry silt loam in an area of Minaloosa-Huckleberry association, very steep. The upper 18 inches is mainly volcanic ash.

IIC1-15 to 23 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark brown (7.5YR 4/4) moist; moderate very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and coarse roots; common fine tubular pores; 45 percent gravel and 15 percent cobblestones; medium acid; clear wavy boundary.

IIC2-23 to 36 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and coarse roots; common fine tubular pores; 45 percent gravel and

30 percent cobblestones; neutral; clear wavy boundary.
IICr-36 inches; slightly weathered quartzite.

The solum is 14 to 20 inches thick. The profile is medium acid to neutral. Bedrock is at a depth of 20 to 40 inches. The B2ir horizon is 14 to 20 inches thick. It has hue of 7.5YR or 10YR and value of 5 or 6. It is 5 to 15 percent gravel and 0 to 5 percent cobblestones. It has bulk density of less than 0.85. The C horizon is 6 to 25 inches thick. It is 15 to 45 percent gravel and 5 to 35 percent cobblestones.

Joel series

The soils in the Joel series are fine-silty, mixed, frigid Ultic Argixerolls.

These very deep, well drained soils are on uplands (fig. 12). The soils formed in loess. Slope is 3 to 60 percent. Elevation is 2,600 to 3,300 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Joel silt loam, 7 to 25 percent slopes, about 920 feet south and 150 feet east of the northwest corner of sec. 32, T. 39 N., R. 3 W.

O1-1.5 inches to 0; undecomposed and partially decomposed organic material.

A11-0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; medium acid; clear wavy boundary.

A12-3 to 7 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; common very fine and fine tubular pores; strongly acid; clear wavy boundary.

A3-7 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular pores and few medium tubular pores; medium acid; clear smooth boundary.

B&A-15 to 26 inches; B part is brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist, A part is pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and coarse roots and many medium roots; many very fine and fine tubular pores and common medium tubular pores; medium acid; clear smooth boundary.

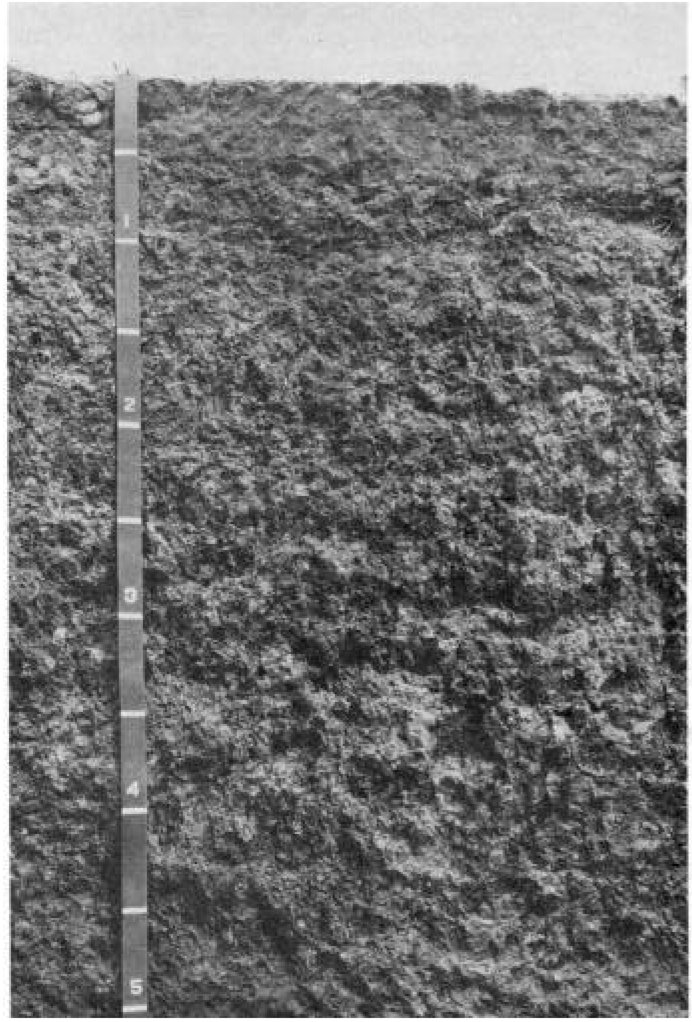


Figure 12.-Profile of Joel silt loam, 3 to 7 percent slopes. This very deep, well drained soil formed in loess.

B21tcn-26 to 41 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak fine prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, slightly sticky and plastic; many fine and medium roots and common coarse roots; many very fine and fine tubular pores and common medium tubular pores; common moderately thick strong brown (7.5YR 5/6) clay films on faces of peds; many fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; clear wavy boundary.

B22tcn-41 to 56 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, sticky and plastic; few fine and medium flattened roots; common very fine and fine tubular pores; continuous thick yellowish red (5YR 4/6) clay films on faces of peds and in pores; many fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; clear wavy boundary.

B23tcn-56 to 60 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, sticky and plastic; few fine and medium flattened roots; common very fine and fine tubular pores; continuous moderately thick strong brown (7.5YR 5/6) clay films on faces of peds and in pores; many fine iron and manganese concretions less than 2 millimeters in diameter; neutral.

The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 10 to 20 inches thick. It is slightly acid to strongly acid. The B2t horizon is 25 to 45 inches thick. It is silt loam or silty clay loam and is 24 to 32 percent clay.

Keuterville series

The soils in the Keuterville series are loamy-skeletal, mixed, mesic Ultic Argixerolls.

These very deep, well drained soils are on sides of canyons. The soils formed in residuum and colluvium derived from basalt. Some loess is in the upper part. Slope is 35 to 65 percent. Elevation is 1,200 to 2,600 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 120 days.

Typical pedon of a Keuterville cobbly loam in an area of Bluesprin-Keuterville complex, 35 to 65 percent slopes, about 1,500 feet east of the southwest corner of sec. 9, T. 38 N., R. 2 W.

A1-0 to 3 inches; dark brown (10YR 4/3) gravelly silt loam, very dark brown (10YR 2/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; 10 percent gravel and 5 percent cobblestones; neutral; clear wavy boundary.

A3-3 to 13 inches; dark brown (10YR 3/3) cobbly silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly sticky, friable, slightly sticky and slightly plastic; many fine and medium and common coarse roots; many fine tubular pores; 10 percent gravel and 10 percent cobblestones; neutral; clear wavy boundary.

B21t-13 to 26 inches; dark brown (10YR 4/3) very gravelly silty clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots and few coarse roots; many fine tubular pores; few moderately thick clay films on faces of peds and in pores; 35 percent gravel and 10 percent cobblestones; slightly acid; gradual wavy boundary.

B22t-26 to 38 inches; dark brown (10YR 4/3) extremely cobbly clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots and few coarse roots; many fine tubular pores; common moderately thick clay films on faces of peds; 35 percent gravel and 30 percent cobblestones; slightly acid; gradual wavy boundary.

B23t-38 to 44 inches; dark brown (7.5YR 4/4) extremely cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine angular blocky structure; hard, firm, sticky and plastic; few fine. and medium roots; many fine tubular pores; common moderately thick clay films on faces of peds; 35 percent gravel and 40 percent cobblestones; slightly acid; clear wavy boundary.

B3t-44 to 60 inches; dark brown (7.5YR 4/4) extremely gravelly clay loam, dark brown (7.5YR 3/4) moist; moderate fine angular blocky structure; slightly hard, firm, sticky and plastic; few fine, medium, and coarse roots; many fine tubular pores; common moderately thick clay films on faces of peds; 50 percent gravel and 20 percent cobblestones; neutral.

The profile is slightly acid or neutral. It has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 10 to 15 inches thick. It has hue of 7.5YR or 10YR and value of 3 or 4. It is 15 to 30 percent gravel and 0 to 5 percent cobblestones. The B2t horizon is 20 to 40 inches thick. It has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is 35 to 45 percent gravel and 0 to 30 percent cobblestones.

Klickson series

The soils in the Klickson series are loamy-skeletal, mixed, frigid Ultic Argixerolls.

These very deep, well drained soils are on valley sides and on canyon slopes. The soils formed in loess and in material derived dominantly from basalt. Slope is 7 to 65 percent. Elevation is 1,400 to 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 100 days.

Typical pedon of Klickson cobbly loam, 35 to 65 percent slopes (fig. 13), about 1,590 feet east and 1,500 feet south of the northwest corner of sec. 9, T. 39 N., R. 2 W.

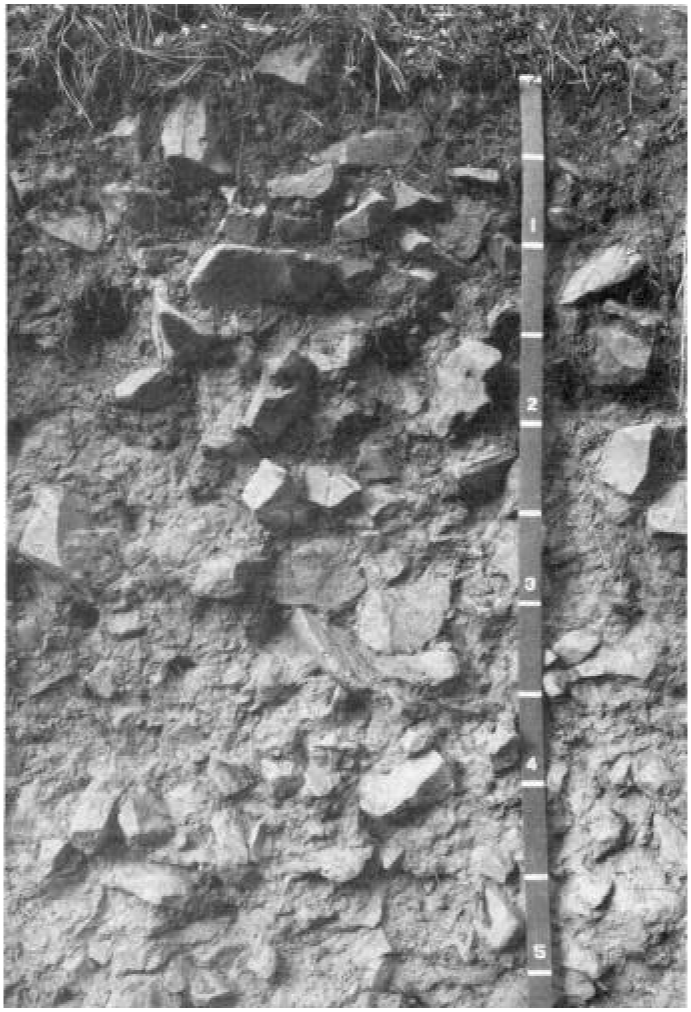


Figure 13.-Profile of Klickson cobbly loam, 35 to 65 percent slopes. This soil formed in loess and basalt.

O1-1 inch to 0; undecomposed and partially decomposed organic material.

A1-0 to 7 inches; brown (10YR 5/3) cobbly loam, very dark brown (10YR 2/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine interstitial pores; 10 percent gravel and 20 percent cobblestones; neutral; clear smooth boundary.

A3-7 to 11 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many fine interstitial pores; 10 percent gravel and 20 percent cobblestones; slightly acid; clear smooth boundary.

B1t-11 to 19 inches; yellowish brown (10YR 5/4) very cobbly loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and common coarse roots; many very fine tubular pores; 30 percent gravel and 20 percent cobblestones; few thin clay films on faces of peds and in pores; slightly acid; gradual wavy boundary.

B21t-19 to 37 inches; light yellowish brown (10YR 6/4) very cobbly loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine, medium, and coarse roots; many very fine tubular pores; 30 percent gravel and 20 percent cobblestones; common thin clay films on faces of peds and in pores; slightly acid; gradual wavy boundary.

B22t-37 to 60 inches; light yellowish brown (10YR 6/4) very cobbly loam, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, firm, sticky and plastic; common medium and few coarse roots; many very fine tubular pores; 30 percent gravel and 20 percent cobblestones; common moderately thick clay films on faces of peds and in pores; slightly acid.

The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 10 to 20 inches thick. It has hue of 7.5YR or 10YR and chroma of 2 or 3. It is 0 to 10 percent gravel and 0 to 25 percent cobblestones. The B2t horizon is 20 to 50 inches thick. It has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is 20 to 50 percent gravel and 10 to 30 percent cobblestones.

Larkin series

The soils in the Larkin series are fine-silty, mixed, mesic Ultic Argixerolls.

These very deep, well drained soils are on uplands. The soils formed in loess. Slope is 3 to 35 percent. Elevation is about 2,600 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typical pedon of Larkin silt loam, 12 to 35 percent slopes, about 1,170 feet west and 400 feet south of the northeast corner of sec. 30, T. 41 N., R. 5 W.

O1-1.5 inches to 0.5 inch; undecomposed organic material.

O2-0.5 inch to 0; decomposed organic material.

A11-0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores; wormholes throughout; neutral; clear wavy boundary.

A12-4 to 9 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine and few medium interstitial pores; wormholes throughout; slightly acid; clear wavy boundary.

A3-9 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine tubular pores and common medium tubular pores; few uncoated silt grains on faces of peds; wormholes throughout; slightly acid; clear wavy boundary.

B1t-15 to 21 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; many fine and medium roots and common very fine and coarse roots; many very fine and fine tubular pores and common medium tubular pores; few thin brown (7.5YR 5/4) clay films on faces of peds; common uncoated silt grains on faces of peds; wormholes throughout; slightly acid; clear smooth boundary.

B21t-21 to 35 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, slightly sticky and slightly plastic; many very fine roots, common fine and medium roots, and few coarse roots; many very fine and fine tubular pores and common medium tubular pores; common thin brown (7.5YR 5/4) clay films on faces of peds; wormholes throughout; medium acid; clear wavy boundary.

B22tcn-35 to 49 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; very firm, sticky and plastic; common fine, medium, and coarse roots; many very fine, fine, and medium tubular pores; many moderately thick reddish brown (5YR 5/4) clay films on faces of peds and in pores; common uncoated silt grains on faces of peds; many fine iron and manganese concretions less than 2 millimeters in diameter; wormholes throughout; medium acid; gradual wavy boundary.

B3tcn-49 to 60 inches; yellowish brown (10YR 5/4) silt loam; dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, sticky and slightly plastic; few fine, medium, and coarse roots; many very fine, fine, and medium tubular pores; many thick and moderately thick reddish brown (5YR 5/4) clay films on faces of peds and in pores; common uncoated silt grains on faces of peds; common fine iron and manganese concretions less than 2 millimeters in diameter; wormholes throughout; slightly acid.

The profile is medium acid to neutral. It has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 10 to 20 inches thick. The B2t horizon is 25 to 40 inches thick. It is silt loam and is 24 to 30 percent clay.

Latah series

The soils in the Latah series are fine, mixed, mesic Xeric Argialbolls.

These very deep, somewhat poorly drained soils are on valley floors. The soils formed in alluvium derived dominantly from loess. Slope is 0 to 3 percent. Elevation is about 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 45 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Latah silt loam, 0 to 3 percent slopes, about 2,290 feet east and 100 feet south of the northwest corner of sec. 10, T. 38 N., R. 5 W.

Ap-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine interstitial pores; neutral; clear wavy boundary.

A12-7 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and coarse subangular blocky structure; very hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; neutral; gradual wavy boundary.

A13-19 to 23 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine tubular pores; neutral; clear wavy boundary.

A21-23 to 27 inches; pale brown (10YR 6/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine tubular and vesicular pores; neutral; gradual wavy boundary.

A22-27 to 32 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; massive; hard, very friable, slightly sticky and slightly plastic; common fine roots; many fine tubular and vesicular pores;

many fine iron and manganese concretions less than 3 millimeters in diameter; neutral; abrupt wavy boundary.

B21t-32 to 42 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, very sticky and very plastic; common fine roots; many fine tubular pores; continuous moderately thick clay films on faces of peds and in pores; common fine iron and manganese concretions less than 2 millimeters in diameter; neutral; gradual wavy boundary.

B22t-42 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, friable, sticky and plastic; few fine flattened roots; few fine tubular pores; continuous moderately thick clay films on faces of peds; dark gray (10YR 3/1) organic coatings; neutral.

The A1 horizon is 17 to 28 inches thick. It has value of 4 or 5 and chroma of 1 or 2. The B2t horizon is silty clay loam that is more than 35 percent clay, or it is silty clay.

Latahco series

The soils in the Latahco series are fine-silty, mixed, frigid Argiaquic Xeric Argialbolls.

These very deep, somewhat poorly drained soils are on valley floors. The soils formed in alluvium derived dominantly from loess. Slope is 0 to 3 percent. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of a Latahco silt loam in an area of Palouse-Latahco silt loams, 0 to 3 percent slopes, about 1,570 feet south and 350 feet east of the northwest corner of sec. 15, T. 39 N., R. 5 W.

Ap-0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine interstitial pores; medium acid; abrupt smooth boundary.

A12-8 to 14 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; slightly acid; clear smooth boundary.

A13-14 to 20 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; slightly acid; clear smooth boundary.

A21cn-20 to 24 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine tubular pores; common fine black iron and manganese concretions less than 2 millimeters in diameter; slightly acid; clear smooth boundary.

A22cn-24 to 28 inches; light gray (10YR 7/2) silt, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many fine tubular pores; many fine black iron and manganese concretions less than 3 millimeters in diameter; slightly acid; abrupt wavy boundary.

B21tcn-28 to 36 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; few fine roots; many fine tubular pores; many fine black iron and manganese concretions less than 3 millimeters in diameter; peds capped with uncoated silt grains; common moderately thick clay films in pores and on faces of peds; slightly acid; gradual wavy boundary.

B22tcn-36 to 46 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse angular blocky; very hard, very firm, sticky and plastic; few fine roots; many fine tubular pores; few fine black iron and manganese concretions less than 3 millimeters in diameter; common moderately thick clay films in pores and on faces of peds; slightly acid; gradual wavy boundary.

B23tcn-46 to 60 inches; light gray (10YR 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse angular blocky; very hard, firm, sticky and plastic; few fine roots; many fine tubular pores; few fine black iron and manganese concretions less than 2 millimeters in diameter; common moderately thick clay films in pores and on faces of peds; slightly acid.

The A1 horizon is 13 to 20 inches thick. It has value of4 or 5 and chroma of 1 or 2. The B2t horizon is silty clay loam or silt loam and is 25 to 35 percent clay.

These soils are taxadjuncts to the Latahco series because they have an abrupt textural change from the A22cn horizon to the B21tcn horizon.

Lovell series

The soils in the Lovell series are fine-silty, mixed, frigid Ultic Haploxeralfs.

These very deep, somewhat poorly drained soils are on flood plains. The soils formed in alluvium derived dominantly from loess. Slope is 0 to 3 percent. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Lovell silt loam, 0 to 3 percent slopes, about 2,000 feet east and 1,820 feet north of the southwest corner of sec. 19, T. 39 N., R. 3 W.

A1-0 to 5 inches; gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine and fine interstitial pores; medium acid; clear wavy boundary.

A21 cn-5 to 11 inches; light gray (10YR 6/1) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine, medium, and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; medium acid; clear wavy boundary.

A22cn-11 to 28 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; 3-inch krotovina crossing horizon vertically from 14 to 25 inches; medium acid; abrupt wavy boundary.

B21tcn-28 to 37 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium and coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm, slightly sticky and slightly plastic; common very fine and fine roots flattened on vertical faces of peds; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; continuous thick clay films on faces of prisms; medium acid; abrupt wavy boundary.

B22tcn-37 to 60 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 4/3) moist; moderate medium to very coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm, sticky and plastic; few fine roots flattened on vertical faces of peds; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; many moderately thick clay films in pores and on faces of peds; slightly acid.

The profile is medium acid to neutral. It has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A1 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. The A2 horizon is 10 to 25 inches thick. The B horizon has hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 3 or 4.

Minaloosa series

The soils in the Minaloosa series are loamy-skeletal, mixed, frigid Dystric Xerochrepts.

These very deep, well drained soils are on mountainsides. The soils formed in loess and in residuum and colluvium derived dominantly from metasedimentary rock. Slope is 35 to 65 percent. Elevation is 2,700 to 4,300 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 44 degrees F, and the average frost-free season is about 110 days.

Typical pedon of a Minaloosa loam in an area of Minaloosa-Huckleberry association, very steep, about 1,850 feet west and 1,500 feet north of the southeast corner of sec. 18, T. 43 N., R. 4 W.

O1-0.5 inch to 0; undecomposed and partially decomposed organic material.

A1-0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine interstitial pores; 10 percent fine gravel; medium acid; clear wavy boundary.

B1-6 to 12 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common medium roots; many fine interstitial pores; 10 percent gravel and 5 percent cobblestones; medium acid; clear wavy boundary.

B21t-12 to 22 inches; light yellowish brown (10YR 6/4) gravelly loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and common medium roots; many fine tubular pores; 25 percent gravel and 5 percent cobblestones; very few thin clay films; medium acid; gradual wavy boundary.

B22t-22 to 34 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and few medium roots; many fine tubular pores; 35 percent gravel and 5 percent cobblestones; very few thin clay films; medium acid; gradual wavy boundary.

C1-34 to 47 inches; very pale brown (10YR 7/3) very gravelly loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine tubular pores; 50 percent gravel and 10 percent cobblestones; strongly acid; gradual wavy boundary.

C2-47 to 60 inches; very pale brown (10YR 7/4) extremely gravelly loam, yellowish brown (10YR 5/6) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; no roots; common fine tubular pores; 70 percent gravel; strongly acid.

The solum is 20 to 40 inches thick. The profile is 20 to 55 percent gravel and 0 to 15 percent cobblestones and averages more than 35 percent rock fragments between depths of 10 and 40 inches. Between depths of 10 and 30 inches, the profile has base saturation of 40 to 60 percent. The A horizon has value of 5 or 6 and chroma of 3 or 4. It is 0 to 15 percent gravel. The B2t horizon is 15 to 30 inches thick.

Molly series

The soils in the Molly series are coarse-loamy, mixed Andic Cryochrepts.

These deep, well drained soils are on mountainsides. The soils formed in volcanic ash underlain by residuum derived dominantly from schist: Slope is 35 to 65 percent. Elevation is 3,200 to 4,200 feet. The average annual precipitation is about 32 inches, the average annual air temperature is about 42 degrees F, and the average frost-free season is about 90 days.

Typical pedon of Molly silt loam, 35 to 65 percent slopes, about 1,900 feet north and 600 feet west of the southeast corner of sec. 33, T. 39 N., R. 1 W.

O1-0.5 inch to 0; undecomposed and partially decomposed organic material.

B2ir-0 to 12 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; many fine interstitial pores; slightly acid; abrupt wavy boundary.

IIC1-12 to 28 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many fine tubular pores; many fine mica flakes; medium acid; gradual wavy boundary.

IIC2-28 to 37 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; many fine tubular pores; many fine mica flakes; 5 percent gravel; slightly acid; gradual wavy boundary.

IIC3-37 to 59 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many fine tubular pores; many fine mica flakes; 10 percent gravel; slightly acid; clear smooth boundary.

Cr-59 inches; slightly weathered mica schist.

The solum is 7 to 14 inches thick. The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. Paralithic contact is at a depth of 40 to 60 inches. The B2ir horizon is 7 to 14 inches thick. It has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. It is 0 to 10 percent gravel. It has bulk density of less than 0.85. The C horizon is 30 to 50 inches thick. It is 0 to 10 percent gravel.

Naff series

The soils in the Naff series are fine-silty, mixed, mesic Ultic Argixerolls.

These very deep, well drained soils are on uplands. The soils formed in loess. Slope is 7 to 40 percent. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typical pedon of a Naff silt loam in an area of Naff-Palouse silt loams, 7 to 25 percent slopes, about 700 feet south and 250 feet west of the northeast corner of sec. 19, T. 38 N., R. 5 W.

Ap-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; slightly hard, friable, sticky and plastic; many fine roots; many fine interstitial pores; medium acid; abrupt smooth boundary.

B1-7 to 16 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; many fine tubular pores; medium acid; clear wavy boundary.

B21t-16 to 35 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; hard, firm, sticky and plastic; common fine roots; many fine tubular pores; few uncoated silt grains on faces of prisms; wavy clayey bands 2 1/4 inches thick; few fine iron and manganese concretions less than 2 millimeters in diameter; common moderately thick clay films on faces of peds and in pores; slightly acid; gradual wavy boundary.

B22t-35 to 47 inches; brown (10YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate medium prismatic structure parting to strong very fine angular blocky; hard, firm, very sticky and very plastic; common fine roots; many fine tubular pores; few uncoated silt grains on faces of prisms; wavy clayey bands 2 1/4 inches thick; many moderately thick clay films on faces of peds and in pores; slightly acid; gradual wavy boundary.

B23t-47 to 60 inches; yellowish brown (10YR 5/4) silty clay loam, dark brown (7.5YR 4/3) moist; strong very fine angular blocky structure; hard, friable, very sticky and very plastic; few fine roots; many fine tubular pores; few coarse vertical worm channels lined with dark grayish brown soil material; many moderately thick clay films on faces of peds and in pores; slightly acid.

The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 7 to 20 inches thick. It is medium acid to neutral. The B2t horizon has value of 5 or 6 and chroma of 3 or 4.

Palouse series

The soils in the Palouse series are fine-silty, mixed, mesic Pachic Ultic Haploxerolls.

These very deep, well drained soils are on uplands. The soils formed in loess. Slope is 2 to 25 percent. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typical pedon of Palouse silt loam, 3 to 7 percent slopes, about 2,590 feet east and 200 feet south of the northwest corner of sec. 14, T. 37 N., R. 4 W.

Ap-0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; medium acid; abrupt smooth boundary.

A3-8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid; clear smooth boundary.

B1-15 to 25 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; few coarse vertical worm channels partially filled with A material; slightly acid; clear wavy boundary.

B21-25 to 33 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; few coarse vertical worm channels partially filled with A material; 3-inch krotovina at a depth of 31 inches filled with granular A material; slightly acid; clear wavy boundary.

B22t-33 to 53 inches; light yellowish brown (10YR 6/4) silt loam, .dark yellowish brown (10YR 3/4) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; few coarse vertical worm channels partially filled with A material; wavy clayey bands 4 1/2 inches thick; medium acid; gradual wavy boundary.

B23t-53 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; wavy clayey bands 2 1/2 inches thick; medium acid.

The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 14 to 30 inches thick. It is medium acid to neutral. The B2 horizon has value of 5 or 6 and chroma of 3 or 4. It is silt loam or silty clay loam and is 20 to 30 percent clay.

Porrett series

The soils in the Porrett series are fine-silty, mixed, frigid Andaqueptic Ochraqualfs.

These very deep, poorly drained soils are on valley floors. The soils formed in alluvium derived dominantly from loess and volcanic ash. Elevation is about 2,700 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 80 days.

Typical pedon of Porrett silt loam, 0 to 3 percent slopes, about 1,880 feet east and 1,060 feet north of the southwest corner of sec. 28, T. 41 N., R. 3 W.

O1-2 inches to 1 inch; fresh and partly decomposed organic material.

O2-1 inch to 0; decomposed organic material.

A1-0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; strong fine platy structure; soft, very friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine interstitial pores; many fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; clear smooth boundary.

A21-5 to 11 inches; light gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine distinct mottles; strong fine platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; medium acid; clear wavy boundary.

A22-11 to 24 inches; light gray (10YR 7/2) silt loam, brown (10YR 4/3) moist; many fine distinct mottles;

massive; hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; medium acid; abrupt wavy boundary.

B21t-24 to 32 inches; pale brown (10YR 6/3) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; strong very coarse prismatic structure; very hard, firm, sticky and plastic; many fine roots on faces of prisms, no roots within peds; many fine tubular pores; continuous thick clay films on faces of prisms and common moderately thick clay films in pores; many fine iron and manganese concretions less than 3 millimeters in diameter; neutral; clear wavy boundary.

B22t-32 to 48 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very coarse prismatic structure; very hard, friable, sticky and plastic; few fine roots on faces of prisms, no roots within peds; many fine tubular pores; common moderately thick clay films on faces of prisms and common thin clay films in pores; common fine iron and manganese concretions less than 1 millimeter in diameter; few very fine mica flakes; neutral; gradual wavy boundary.

B3t-48 to 60 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; common medium distinct mottles; massive; very hard, friable, sticky and plastic; no roots; many fine tubular pores; very few thin clay films in pores; many fine iron and manganese concretions less than 1 millimeter in diameter; few very fine mica flakes; neutral.

The A1 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. The A2 horizon is 15 to 25 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 or 3. It is slightly acid or neutral.

Santa series

The soils in the Santa series are coarse-silty, mixed, frigid Typic Fragixeralfs.

These very deep, moderately well drained soils are on uplands. The soils formed in loess. Slope is 2 to 35 percent. Elevation is about 2,800 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 100 days.

Typical pedon of Santa silt loam, 5 to 20 percent slopes, about 2,300 feet north and 1,600 feet east of the southwest corner of sec. 29, T. 40 N., R. 2 W.

Ap-0 to 8 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; slightly acid; clear smooth boundary.

B1-8 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid; gradual smooth boundary.

B2t-15 to 23 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; very few thin clay films on faces of peds; few fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; gradual wavy boundary.

A2-23 to 26 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; abrupt wavy boundary.

Bx1tb-26 to 30 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to weak medium subangular blocky; very hard, very firm and brittle, sticky and plastic; common very fine roots on faces of prisms; common fine tubular pores; many thick clay films on faces of prisms and in pores; few fine iron and manganese concretions less than 2 millimeters in diameter; many uncoated silt grains on tops of prisms and few uncoated silt grains within peds; medium acid; gradual wavy boundary.

Bx2tb-30 to 37 inches; strong brown (7.5YR 5/6) silty clay loam, dark brown (7.5YR 4/4) moist; moderate very coarse prismatic structure parting to strong medium and fine angular blocky; very hard, very firm and brittle, sticky and plastic; few fine roots on faces of prisms; moderate fine tubular pores; many thick clay films on faces of peds and in pores; few fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; gradual wavy boundary.

Bx3tb-37 to 53 inches; light yellowish brown (10YR 6/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate very coarse prismatic structure parting to weak coarse angular blocky; very hard, very firm and brittle, sticky and plastic; few fine roots on faces of prisms; moderate fine tubular pores; many moderately thick clay films on faces of peds and in pores; few fine iron and manganese concretions less than 2 millimeters in diameter; neutral; gradual wavy boundary.

Bx4tb-53 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak coarse angular blocky; very hard, firm, slightly sticky and slightly plastic; no roots; moderate fine tubular pores; many thick clay films on faces of peds and in pores; many fine iron and manganese concretions less than 3 millimeters in diameter; neutral.

Depth to the Bx1tb horizon is 20 to 36 inches. The Bx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

Schumacher series

The soils in the Schumacher series are fine-loamy, mixed, mesic Ultic Argixerolls.

These deep, well drained soils are on uplands. The soils formed in loess and in residuum derived dominantly from metasedimentary or granitic rock. Slope is 10 to 35 percent. Elevation is 2,700 to 3,800 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 130 days.

Typical pedon of Schumacher silt loam, 10 to 35 percent slopes, about 1,900 feet west and 300 feet south of the northeast corner of sec. 24, T. 43 N., R. 6 W.

Ap-0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roofs; many very fine interstitial pores; neutral; clear smooth boundary.

A12-8 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many very fine and few medium tubular pores; neutral; gradual smooth boundary.

B21t-19 to 33 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; strong fine and medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and plastic; common very fine and few fine roots; many very fine and few medium tubular pores; very few thin clay films on faces of peds; 5 percent fine gravel; neutral; gradual smooth boundary.

B22t-33 to 45 inches; yellowish brown (10YR 5/4) silt loam, brown (10YR 4/3) moist; weak very fine and fine subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and few medium tubular pores; very few thin clay films on faces of peds; 10 percent fine gravel; neutral; gradual smooth boundary.

B3-45 to 56 inches; brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) moist; weak very fine subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine vesicular pores; 30 percent gravel; neutral; clear smooth boundary.

Cr-56 inches; partially decomposed metasedimentary rock.

Thickness of the solum and depth to the paralithic contact range from 40 to 60 inches. The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A1 horizon is 12 to 20 inches thick. It is 0 to 15 percent gravel. The B2t horizon is 15 to 30 inches thick. It is 5 to 25 percent gravel and 0 to 5 percent cobblestones.

Schumacher Variant

The Schumacher Variant soils are loamy-skeletal, mixed, mesic, shallow Ultic Argixerolls.

These shallow, well drained soils are on uplands. The soils formed in loess and in residuum derived dominantly from metasedimentary or granitic rock. Slope is 15 to 55 percent. Elevation is 2,800 to 3,800 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 150 days.

Typical pedon of Schumacher Variant loam, 15 to 55 percent slopes; about 3,100 feet north and 1,750 feet east of the southwest corner of sec. 30, T. 44 N., R. 5 W.

A11-0 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; common very fine and fine interstitial pores; 5 percent gravel; neutral; clear smooth boundary.

B21t-10 to 15 inches; yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine tubular pores; 50 percent gravel; slightly acid; gradual smooth boundary.

B22t-15 to 19 inches; brown (7.5YR 5/4) extremely gravelly loam, brown (7.5YR 4/4) moist; strong fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; 70 percent gravel; slightly acid; clear smooth boundary.

Cr-19 inches; weathering quartzite; few fine roots along fractures in the upper 10 inches.

The thickness of the solum and depth to paralithic contact range from 10 to 20 inches. The B2t horizon is 35 to 50 percent gravel. It has base saturation of less than 75 percent in at least some part.

Southwick series

The soils in the Southwick series are fine-silty, mixed, mesic Argiaquic Xeric Argialbolls.

These very deep, moderately well drained soils are on uplands. The soils formed in loess: Slope is 3 to 35 percent. Elevation is About 2,700 feet. The average annual precipitation is about 23 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 130 days.

Typical pedon of Southwick silt loam, 12 to 25 percent slopes (fig. 14), about 1,395 feet south and 1,330 feet west of the northeast corner of sec. 15, T. 42 N., R. 5 W.

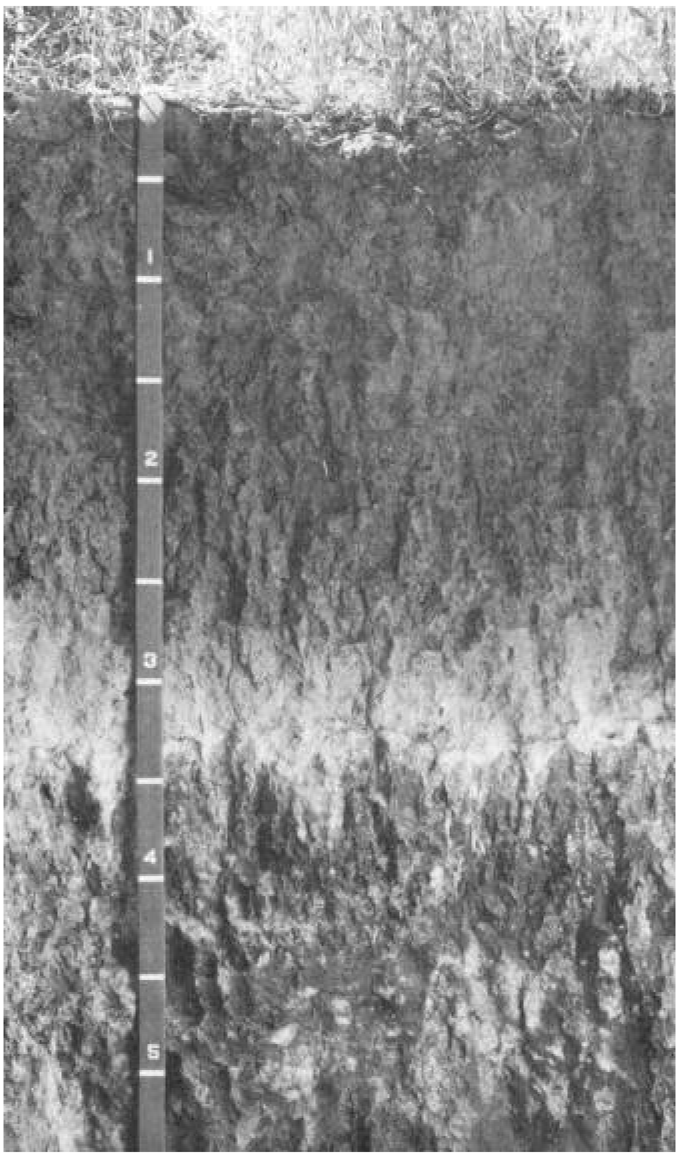


Figure 14.-Profile of Southwick silt loam, 12 to 25 percent slopes. This soil has a seasonal perched water table above the buried subsoil.

Ap-0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; medium acid; abrupt smooth boundary.

A12-7 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; medium acid; abrupt smooth boundary.

B21-11 to 18 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid; gradual wavy boundary.

B22t-18 to 28 inches; brown. (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; very few thin clay films in pores; medium acid; gradual wavy boundary.

A21 cn-28 to 34 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; common fine iron and manganese concretions less than 2 millimeters in diameter; medium acid; clear smooth boundary.

A22cn-34 to 38 inches; light gray (10YR 7/2) silt, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine and fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; medium acid; clear wavy boundary.

B21tbcn-38 to 43 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots flattened on faces of prisms; many fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; many uncoated silt grains on tops of prisms; common moderately thick clay films in pores and on faces of peds; common dark organic stains on faces of peds; medium acid; gradual wavy boundary.

B22tbcn-43 to 60 inches; pale brown (10YR 6/3) silty clay loam; brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong coarse and medium subangular blocky; very hard, firm, sticky and plastic; common fine and few medium roots flattened on faces of prisms; many fine tubular pores; few fine iron and manganese concretions less than 3 millimeters in diameter; few pockets of uncoated silt grains along faces of peds; many thick clay films in pores and on faces of peds; medium acid.

The profile is medium acid to neutral. Depth to the B21tbcn horizon is 23 to 38 inches. The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

The Southwick soil in unit 47 is a taxadjunct to the series because it has a thinner A horizon and is shallower to the top of the argillic horizon than is defined in the range for the series.

Spokane series

The soils in the Spokane series are coarse-loamy, mixed, mesic Ultic Haploxerolls.

These moderately deep, well drained soils are on mountainsides. The soils formed in loess and in residuum derived dominantly from granite. Slope is 15 to 65 percent. Elevation is 2,800 to 3,800 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 120 days.

Typical pedon of a Spokane loam in an area of Uvi-Spokane association, very steep, about 2,390 feet south and 1,520 feet east of the northwest corner of sec. 9, T. 40 N., R. 5 W.

O1-2 inches to 0.5 inch; undecomposed and partially decomposed organic material.

O2-0.5 inch to 0; decomposed organic material.

A11-0 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots, common medium roots, and few coarse roots; many very fine interstitial pores; neutral; clear smooth boundary.

A12-6 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots, common medium roots, and few coarse roots; many very fine interstitial pores; 10 percent fine gravel; neutral; clear smooth boundary.

B2-10 to 15 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; many fine tubular pores; few fine mica flakes; 20 percent fine gravel; neutral; clear wavy boundary.

C1-15 to 22 inches; light yellowish brown (10YR 6/4) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; many fine tubular pores,; many fine mica flakes; 20 percent gravel; neutral; clear wavy boundary.

C2-22 to 28 inches; pale brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots and few medium and coarse roots; many fine vesicular pores; many fine mica flakes; 20 percent gravel; neutral; clear wavy boundary.

Cr-38 inches; decomposing granite.

The solum is 12 to 30 inches thick. Paralithic contact is at a depth of 20 to 40 inches. The profile between a depth of 10 inches and paralithic contact is 20 to 30 percent gravel and 0 to 10 percent cobblestones. The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches. The A horizon is 7 to 15 inches thick. It has value of 4 or 5 and chroma of 2 or 3. It is slightly acid or neutral.

Taney series

The soils in the Taney series are fine-silty, mixed, frigid Boralfic Argixerolls.

These very deep, moderately well drained soils are on uplands. The soils formed in loess. Slope is 3 to 35 percent. Elevation is about 2,800 feet. The average annual precipitation is about 25 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Taney silt loam, 3 to 7 percent slopes, about 2,250 feet east and 1,080 feet south of the northwest corner of sec. 4, T. 39 N., R. 3 W.

Ap-0 to 7 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate thin platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and few coarse roots; many very fine and fine interstitial pores; medium acid; abrupt smooth boundary.

A12-7 to 10 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few coarse roots; many very fine and fine tubular pores; medium acid; abrupt wavy boundary.

B2-10 to 16 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few coarse roots; many very fine and fine tubular pores; strongly acid; clear wavy boundary.

A21b-16 to 22 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine and few coarse roots; many very fine and fine tubular pores; medium acid; clear wavy boundary.

A22bcn-22 to 27 inches; light gray (10YR 7/2) silt, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; many very fine and fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; medium acid; abrupt wavy boundary.

B21tbcn-27 to 37 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate coarse and medium prismatic structure parting to moderate coarse subangular blocky; very hard, very firm, sticky and plastic; common fine roots on faces of prisms; many very fine and fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; many thick clay films in pores and on faces of peds; many dark brown organic stains on prisms; many uncoated silt grains within peds; medium acid; gradual wavy boundary.

B22tbcn-37 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; strong coarse prismatic structure parting to strong medium and coarse subangular blocky; very hard, very firm, sticky and plastic; common fine roots on faces of prisms; many very fine and fine tubular pores; many fine iron and manganese concretions less than 3 millimeters in diameter; many thick clay films in pores and on faces of peds; few pockets of uncoated silt grains between peds; slightly acid.

The profile is strongly acid to slightly acid. It has base saturation of less than 75 percent in at least some part of the upper 30 inches. The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or. 4.

Thatuna series

The soils in the Thatuna series are fine-silty, mixed, mesic Xeric Argialbolls.

These very deep, moderately well drained soils are on low terraces and uplands. The soils formed in loess. Slope is 2 to 40 percent. Elevation is about 2,600 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days. Typical pedon of a Thatuna silt loam in an area of Naff-Thatuna silt loams, 7 to 25 percent slopes, about 800 feet south and 100 feet west of the northeast corner of sec. 6, T: 39 N., R. 5 W.

Ap1-0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thick platy structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; medium acid; abrupt smooth boundary.

Ap2-4 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid; abrupt smooth boundary.

A3-9 to 20 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid; clear wavy boundary.

B2-20 to 33 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; medium acid; clear wavy boundary.

A2cn-33 to 39 inches; light gray (10YR 7/2) silt, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; many very fine and fine tubular pores; many fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; wavy boundary.

B2tbcn-39 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm, sticky and plastic; common fine and very fine roots; many very fine and fine tubular pores; many fine iron and manganese concretions less than 2 millimeters in diameter; many moderately thick clay films in pores and on faces of peds; prisms capped with A2 material; medium acid.

Depth to the B2bcn horizon is 29 to 40 inches. This horizon is silt loam or silty clay loam and is 24 to 35 percent clay. It has value of 5 or 6. The B2bcn horizon is medium acid to neutral. It is slightly calcareous below a depth of 43 inches in some pedons.

Tilma series

The soils in the Tilma series are fine, mixed, mesic Xeric Argialbolls.

These very deep, moderately well drained soils are on uplands. The soils formed in loess. Slope is 7 to 25 percent. Elevation is about 2,700 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typical pedon of a Tilma silt loam in an area of Tilma-Garfield silt loams, 7 to 25 percent slopes, about 800 feet south of the northeast corner of sec. 7, T. 37 N., R. 4 W.

A11-0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to weak very fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine interstitial pores; neutral; clear wavy boundary.

A12-3 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine interstitial pores; neutral; clear wavy boundary.

B2-11 to 20 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to weak fine and very fine subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine and few medium tubular pores; slightly acid; clear wavy boundary.

A2-20 to 22 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and very fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; few fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; abrupt smooth boundary.

B21tb-22 to 33 inches; light yellowish brown (10YR 6/4) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine and very fine angular blocky; extremely hard, extremely firm, sticky and very plastic; few fine roots; many fine tubular pores; common moderately thick clay films on faces of peds and in pores; common fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; gradual wavy boundary.

B22tb-33 to 45 inches; light yellowish brown (10YR 6/4) silty clay, dark brown (10YR 7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, very firm, sticky and very plastic; few fine roots; many fine tubular pores; many moderately thick clay films on faces of peds and in pores; common fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid; gradual wavy boundary.

B23tb-45 to 60 inches; light yellowish brown (10YR 6/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium and coarse prismatic structure parting to strong medium and fine angular blocky; extremely hard, very firm, sticky and very plastic; few fine roots; common fine tubular pores; common thin clay films on faces of peds and in pores; common fine iron and manganese concretions less than 2 millimeters in diameter; slightly acid.

Depth to the B21tb horizon is 18 to 26 inches. The Bt horizon is silty clay loam that is more than 35 percent clay, or it is silty clay. It has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 or 4. It is slightly acid or neutral.

Uvi series

The soils in the Uvi series are fine-loamy, mixed, frigid Dystric Xerochrepts.

These very deep, well drained soils are on mountainsides. The soils formed in loess and in residuum derived dominantly from granite. Slope is 5 to 65 percent. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 28 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of Uvi loam, 5 to 20 percent slopes, about 2,000 feet south and 1,000 feet west of the northeast corner of sec. 9, T. 40 N., R. 5 W.

O1-2 inches to 0; undecomposed and partially decomposed organic material.

A11-0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine interstitial pores; medium acid; abrupt wavy boundary. .

A12-3 to 7 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate very fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine interstitial pores; slightly acid; clear wavy boundary.

A13-7 to 18 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to moderate very fine granular; hard, very friable, slightly sticky and slightly plastic; common fine and many medium roots; many fine interstitial pores; slightly acid; clear wavy boundary.

B1-18 to 28 inches; pale brown (10YR 6/3) loam, brown (7.5YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common fine and many medium roots; many fine tubular pores; slightly acid; clear wavy boundary.

B21t-28 to 34 inches; light yellowish brown (10YR 6/4) loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, friable; slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many fine tubular pores; very few moderately thick clay films on faces of peds and in pores; wavy clayey band 1/2 inch thick; medium acid; gradual wavy boundary.

B22t-34 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine tubular pores; very few moderately thick clay films on faces of peds and in pores; three wavy clayey bands 1/2 inch thick; medium acid.

Between depths of 10 arid 30 inches, the profile has base saturation of 40 to 60 percent. The A horizon is 10 to 20 inches thick. It has value of 5 or 6 and chroma of 3 or 4. It is slightly acid or medium acid. The B2t horizon is loam or sandy loam and is 18 to 24 percent clay. It has less than 1.2 times as much clay as the overlying eluvial horizon. In some pedons the B2t horizon does not have clay films. It is 0 to 15 percent gravel.

Vassar series

The soils in the Vassar series are medial over loamy, mixed Entic Cryandepts.

These deep, well drained soils are on mountainsides. The soils formed in volcanic ash that is underlain by residuum derived dominantly from granite. Slope is 5 to 65 percent. Elevation is 2,800 to 4,983 feet. The average annual precipitation is about 45 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 75 days.

Typical pedon of Vassar silt loam, 20 to 35 percent slopes, about 1,240 feet north and 540 feet east of the southwest corner of sec. 13, T. 40 N., R. 4 W.

O1-2 inches to 0.75 inch; undecomposed organic material.

O2-0.75 inch to 0; decomposed organic material.

B21ir-0 to 6 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and few medium roots; many very fine interstitial pores; few fine iron and manganese concretions less than 2 millimeters in diameter; few pieces of charcoal; neutral; clear smooth boundary.

B22ir-6 to 18 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores; few fine iron and manganese concretions less than 2 millimeters in diameter; few pieces of charcoal; neutral; clear smooth boundary.

B23ir-18 to 24 inches; light yellowish brown (10YR 6/4) silt loam, brown (7.5YR 4/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; more "ashy" feel than above horizons; many pieces of charcoal; slightly acid; abrupt wavy boundary.

IIC1-24 to 39 inches; pale brown (10YR 6/3) coarse sandy loam, brown (7.5YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many fine continuous pores; few pieces of charcoal; medium acid; abrupt irregular boundary.

IIC2-39 to 53 inches; very pale brown (10YR 7/3) loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine continuous pores; slightly acid; abrupt wavy boundary.

IIC3r-53 inches; weathering granite.

The solum is 14 to 23 inches thick. Paralithic contact is at a depth of 40 to 60 inches. The B2ir horizon is 14 to 23 inches thick. It has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It has bulk density of less than 0.85. The C horizon is 0 to 30 percent gravel.

Westlake series

The soils in the Westlake series are fine-silty, mixed, frigid Cumulic Ultic Haploxerolls.

These very deep, somewhat poorly drained soils are on flood plains. The soils formed in alluvium derived dominantly from loess. Slope is 0 to 3 percent. Elevation is about 2,600 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 110 days.

Typical pedon of a Westlake silt loam in an area of Westlake-Latahco silt loams, 0 to 3 percent slopes, about 2,520 feet east and 1,510 feet south of the northwest corner of sec. 15, T. 37 N., R. 5 W.

Ap-0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine interstitial pores; neutral; clear smooth boundary.

A12-8 to 18 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; neutral; gradual wavy boundary.

A13-18 to 33 inches; grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; few fine faint mottles; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and plastic; common fine roots; many fine tubular pores; neutral; gradual wavy boundary.

C1-33 to 40 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; common fine distinct mottles; moderate medium and fine subangular blocky structure; very hard, friable, sticky and plastic; common fine roots; many coarse tubular pores lined with A material and common fine tubular pores; many fine iron and manganese concretions less than 2 millimeters in diameter; neutral; gradual wavy boundary.

C2-40 to 49 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; many medium distinct mottles; massive; very hard, friable, sticky and plastic; no roots; many coarse tubular pores lined with A material and common fine tubular pores; common fine iron and manganese concretions less than 2 millimeters in diameter; neutral; gradual wavy boundary.

C3-49 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; many medium distinct mottles; massive; hard, friable, sticky and plastic; no roots; many coarse tubular pores lined with A material and few fine tubular pores; common fine iron and manganese concretions less than 2 millimeters in diameter; neutral.

The solum is 20 to 35 inches thick. In the upper 20 inches, organic carbon content decreases irregularly with depth. The profile has base saturation of less than 75 percent in at least some part of the upper 30 inches.

Formation of the soils

Each soil in the survey area is a natural, three-dimensional body on the earth's surface that supports or is capable of supporting plants. Physical and chemical processes have determined its morphology. These processes have resulted from the interaction of five factors-parent material, climate, living organisms, relief, and time. Differences between unlike soils can be traced to differences in one or more of these factors. How they have influenced soil formation in this area is discussed in the following pages.

Parent material

Parent material is the unconsolidated mass from which all soils developed. Several contrasting parent materials are in the survey area. They are metasedimentary rock, intrusive igneous rock, basalt, loess, volcanic ash, and alluvium. In many places the soils formed in two parent materials such as loess mixed with basalt residuum. Examples are the soils of the Agatha and Keuterville series.

The oldest parent material in the survey area is Pre-cambrian metasediment, which is on the low mountains along the northern part of the area. Elevation in this part of the area ranges from 2,700 to 4,300 feet, and slopes are very steep. The soils commonly are more than 35 percent rock fragments, mostly quartzite and shale. Minaloosa and Huckleberry soils are examples.

Cambrian metasediment, mostly schist, occurs on similar topography along the eastern edge of the area. The soils are loamy throughout and contain minor amounts of rock fragments. The Molly soils are common in this part of the area.

Cretaceous intrusive rock related to the Idaho Batholith occurs on low mountains, mainly in the central part of the survey area (7). Elevation ranges from 2,800 to 4,983 feet, and slopes are very steep. The soils in this area are moderately coarse textured and coarse textured in the substratum. They include the soils of the Spokane and Vassar series.

Most areas of soils derived from metasediment and intrusive rock have varying amounts of loess mixed into the surface layer. In some places volcanic ash caps these materials.

Many separate flows of Columbia River Basalt of Miocene age filled the lower lying topography in the area (fig. 15). The surface of these flows was generally a plain. The Potlatch River and its tributaries flowing from higher elevations cut channels into this plain, producing canyons in the southeastern part of the area. Among the smaller valleys is the Cow Creek valley near Genesee. Soils that formed partly in residuum derived from basalt occur mainly on the canyon topography where the basalt was not covered with deep loess. Klickson and Bluesprin soils are common in this area. These and other soils derived from basalt have more than 35 percent rock fragments in the subsoil. They also have varying amounts of loess mixed into the surface layer.

Glaciers at different times during the Pleistocene advanced into Idaho from Canada as far as the Coeur d'Alene area. Glacial melt water at these times spread large amounts of rock flour over parts of south-central Washington. Strong prevailing winds carried this material into the survey area and deposited it as loess. These deposits make up the Palouse Formation, which is more than 100 feet thick (5). This formation is common in the western part of the area, and it covers most of the Columbia River Basalt. Lesser amounts occur toward the east. Minor amounts of loess are in the soils on the steep slopes of canyons and mountains. These loess deposits accumulated during each glaciation. At least seven different deposits of loess of Pleistocene age and a deposit of loess of Recent age are recognized (8).

Most soils in the area have at least some loess as parent material. Twelve series formed entirely in loess, including the soils of the Palouse, Southwick, and Joel series.

Unique topography produced by loess deposits, known as the "Palouse hills," occurs in the western part of the area. It is a peculiar linear landscape, somewhat resembling sand dunes, that is partly the result of the action of the wind during deposition but is mostly the result of erosion from the melting of large snowdrifts, which accumulated on north-facing slopes. The topography is more

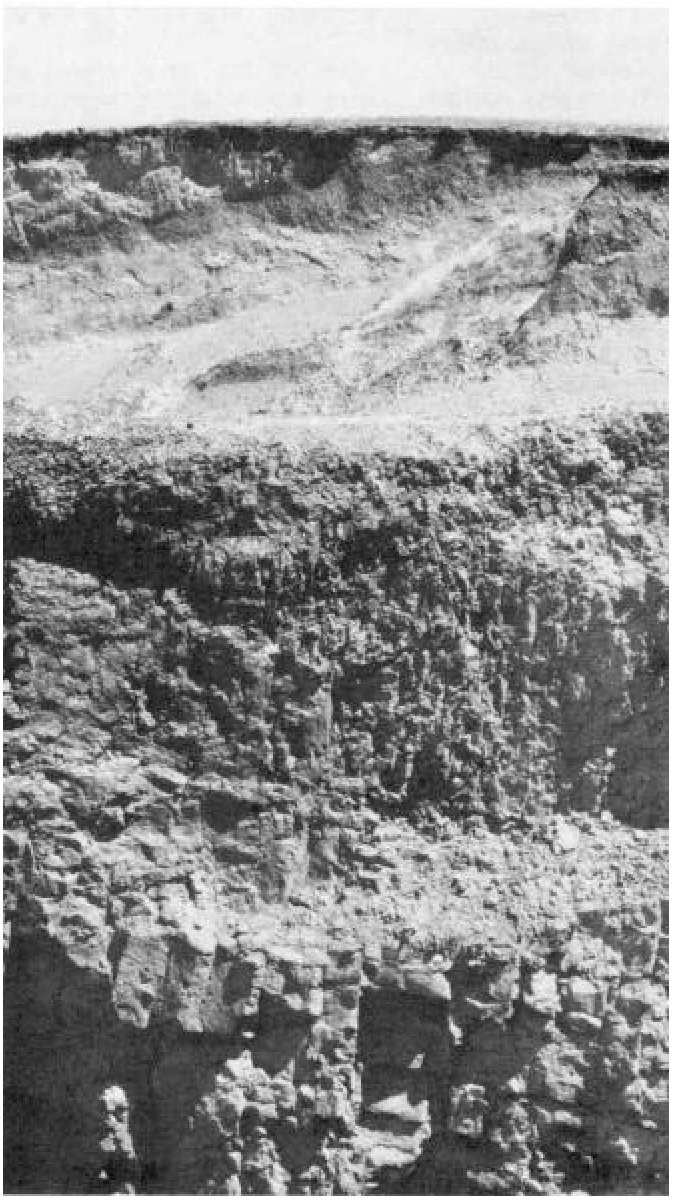


Figure 15. -Profile of Columbia River Basalt that is capped with deposits of loess.

subdued toward the east, mainly because of the presence of a cover of trees that has reduced the drifting of snow.

Soil formation in the loess has not been uniform throughout the area, partly because of the different ages of the loess. This has resulted in at least three contrasting soil profiles. Soils that have an A1 and B2 or B2t genetic horizon sequence, such as the Palouse and Larkin soils, developed in loess of one deposition. Soils that have an A1, B2, A2b, and B2tb horizon sequence, such as the Thatuna and Taney soils, formed in loess of different ages. Soils that formed in the older loess developed an A1 and B2t profile, with the B2t horizon weathering and accumulating by eluviation to about 30 to 35 percent clay. This profile was then covered by more recent loess. The A1 horizon of the older soils was transformed into an A2 horizon at the same time that the lower part of the recent loess attained the characteristics of a B2 horizon.

The third kind of soil profile that formed in loess is also of two ages; however, the older loess is much older and has accumulated more clay, about 35 to 50 percent. It had acquired the minimal characteristics of a Vertisol before finally being covered with a deposit of Recent loess sufficient to halt further development as a Vertisol. Examples are the soils of the Tilma and Driscoll series.

Another influence of glaciation has been the development of patterned ground in this periglacial area. During periods of glaciation, the area was considerably colder and the soils were frozen much of the time. The thawing of the frozen soils on south-facing slopes, mostly in the canyons where bedrock was less than about 4 feet deep, was uneven. This produced a polygon pattern, which allowed erosion to take place in the partially thawed areas. The result is a complex soil area of mounds and intermounds and, in places, of steeper slopes that are greatly elongated. Bluesprin and Flybow soils occur in this area.

The volcanic ash in this area originated from many active volcanoes in western Washington and western Oregon, such as Mt. St. Helens, Mt. Rainier, and Glacier Peak. The greatest contribution of ash in this area, however, came about 6,600 years ago from the Plinian eruption of Mount Mazama, the cone of which is now Crater Lake, in southwestern Oregon. The ash fell over the entire area but was immediately eroded from landscapes that did not have a full cover of trees. Because the climate was significantly drier when the ash fell, the only soils that now have this parent material are those of the Helmer, Huckleberry, Molly, and Vassar series. These soils at that time had a cover of Douglas-fir, which was sufficient to retain the ash that fell.

Alluvium from a variety of sources is in low-lying positions throughout the area. Among the soils that formed in alluvium are those of the Hampson, Latahco, and Porrett series.

Climate

Climate has been a strong influence in the development of soils in the survey area. It was directly and wholly responsible for the delivery by wind of the very important and widespread parent material of the soils that formed in loess.

The degree of leaching of soluble material such as calcium carbonate depends on the amount of precipitation received. Most of the soils in the area have received enough moisture to remove the calcium carbonate. However, the soils in the southwest corner of the area, which have received the least precipitation, have an accumulation of calcium carbonate in the lower part of the profile. An example is the soils of the Athena series. There is also an included soil in this area that has calcium carbonate in the surface layer.

The survey area has some of the lowest rainfall erosion indexes in the United States (12); thus, the shaping of the landscape is more the result of the differential melting of snow drifts than the kinetic energy of falling rain. This is most evident in the "Palouse hills," where snow drifting is more common.

Precipitation ranges from an estimated 20 inches per year in the southwest corner of the area to 45 inches in the higher mountainous parts of the area. This wide range in precipitation is mainly the result of the orographic effect upon moist air masses coming into the area from the Pacific Ocean (4). Climatic contrasts are common within short distances, depending upon the proximity of mountains or ridges.

The indirect effect of precipitation on soil development has been its influence on the kind and amount of vegetation that grows. Within the 20- to 30-inch precipitation zone, small differences in precipitation are highly significant.

Living organisms

All living organisms, including man, affect the development of soils. Different types of vegetation absorb different kinds and amounts of residue and thus influence the kinds of soil that form.

Six general potential native plant communities are in the area, and differences among them are largely a result of differences in climate.

The southern and western parts of the area, with the lowest precipitation and warmest temperatures, support an Idaho fescue-bluebunch wheatgrass plant community. The soils in this part of the area include those of the Naff and Bluesprin series. With increased precipitation and cooler temperatures, the natural vegetation changes. The successive plant communities are ponderosa pine-shrub, Douglas-fir-shrub, grand fir-queencup beadlily, and western redcedar-pachystima. In the coolest parts of the area, at elevations above about 4,500 feet and in narrow valleys that receive cold air drainage from nearby mountains, the subalpine fir-huckleberry plant community is common.

These plant communities have had varying influences on the development of the soils, especially in the upper several inches. As plants die they are incorporated into the soil as organic matter. Because there are more roots available for conversion to organic matter in the Idaho fescue-bluebunch wheatgrass plant community, soils such as those of the Athena and Palouse series have the most organic matter and are the darkest. The soils in the wetter and cooler areas support plant communities that contribute less organic matter, and the soils therefore are lighter colored.

Animal activity also influences the development of soils. Insects, worms, rodents, and other burrowing animals burrow deep into the soils. They mix material from various parts of the soils.

Man's clearing of forests and cultivation of the prairie soils have had an important effect on the soils. Normal tillage operations alter the structure of the upper few inches of the soil and greatly increase erosion. Soil temperature and moisture regimes are also affected. In time these activities change the characteristics of the soils. Until a significant change has occurred, however, the classification of the soils does not change.

Relief

Relief influences the formation of soils through its effect on erosion, the colluvial movement of soil material, natural soil drainage, air drainage, and the modification of climate. These factors are largely determined by the geologic history of the area.

The steeper the slope of the soils, the more rapid the runoff and the greater the possibility for erosion and colluvial activity. Huckleberry and Keuterville soils are examples of the more steeply sloping soils in the area. Soils on steep south-facing slopes are warmer; therefore, they dry out faster and are less subject to leaching of exchangeable bases than are soils on north-facing slopes. They also have contrasting plant communities, which in turn affect soil formation. Nearly level soils on valley floors have slow runoff and are poorly drained to moderately well drained. They also have lower soil temperatures than do soils on adjacent uplands because of cold air drainage. Examples are Hampson, Latahco, and Porrett soils.

Time

The length of time each parent material in the survey area has been subjected to the effects of climate and living organisms and modified by relief is an important factor in the formation of soils. This time can be judged in a comparative sense by a study of the physical and chemical processes which have resulted in soil horizon development.

Soils such as those of the Crumarine and Westlake series formed in Recent alluvium and have had only enough time to accumulate organic matter in the surface layer and to develop a very weak B2 horizon or none at all. These are the youngest soils in the area. Other relatively young soils are those that formed in volcanic ash overlying metasediment or granite. Examples are the Huckleberry and Vassar soils. Geologic erosion on these steep soils has removed soil material as fast as it has formed.

Older soils, such as those of the Naff and Larkin series, formed in loess. These soils have had time for the total amount of clay to increase through weathering and to accumulate in the subsoil.

The oldest soils in the area are those that have a clayey B2 horizon. These soils have been in place long enough for significant weathering to have occurred and for the clay to have accumulated in the subsoil. Examples are the Tilma and Driscoll soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are-

Loose.-Noncoherent when dry or moist; does not hold together in a mass.

Friable.-When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.-When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.-When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.-When dry, breaks into powder or individual grains under very slight pressure.

Cemented.-Hard; little affected by moistening.

Depth to rock. Bedrock is too near the surface for the specified use.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. Practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.-Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.-Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.-Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.-Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but they are wet periodically long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.-Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.-Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.-Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away *of* mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.-An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.-The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

A2 horizon.-A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.-Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metasedimentary rock. Partly metamorphosed sedimentary rock.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance-few, common, and many, size-fine, medium, and coarse; and contrast-faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Plasticity Index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as-

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils that have about the same profile, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site Index. A designation of the. quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0:05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are platy (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), *blocky* (angular or subangular), and *granular.* Structureless soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and management.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy* clay *loam,* day *loam, silty* clay *loam, sandy* clay, *silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth reefers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley floor. A general term for the nearly level to gently sloping floor of a valley. Component landforms include axial stream channels, the flood plain, and low terrace surfaces that may be subject to flooding from tributary streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.